

HEATHKIT[®] MANUAL

for the

MONOCHROME VIDEO MONITOR Model HVM-122A

595-3079-01



HEATH COMPANY • BENTON HARBOR, MICHIGAN

HEATH COMPANY PHONE DIRECTORY

The following telephone numbers are direct lines to the departments listed:

Kit orders and delivery information (616) 982-3411
Credit (616) 982-3561
Replacement Parts (616) 982-3571

Technical Assistance Phone Numbers

8:00 A.M. to 12 P.M. and 1:00 P.M. to 4:30 P.M., EST, Weekdays Only

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YOUR HEATHKIT 90-DAY LIMITED WARRANTY

Consumer Protection Plan for Heathkit Consumer Products

Welcome to the Heath family. We believe you will enjoy assembling your kit and will be pleased with its performance. Please read this Consumer Protection Plan carefully. It is a "LIMITED WARRANTY" as defined in the U.S. Consumer Product Warranty and Federal Trade Commission Improvement Act. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Heath's Responsibility

PARTS — Replacements for factory defective parts will be supplied free for 90 days from date of purchase. Replacement parts are warranted for the remaining portion of the original warranty period. You can obtain warranty parts direct from Heath Company by writing or telephoning us at (616) 982-3571. And we will pay shipping charges to get those parts to you . . . anywhere in the world.

SERVICE LABOR — For a period of 90 days from the date of purchase, any malfunction caused by defective parts or error in design will be corrected at no charge to you. You must deliver the unit at your expense to the Heath factory, any Heathkit Electronic Center (units of Veritechnology Electronics Corporation), or any of our authorized overseas distributors.

TECHNICAL CONSULTATION — You will receive free consultation on any problem you might encounter in the assembly or use of your Heathkit product. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

NOT COVERED — The correction of assembly errors, adjustments, calibration, and damage due to misuse, abuse, or negligence are not covered by the warranty. Use of corrosive solder and/or the unauthorized modification of the product or of any furnished component will void this warranty in its entirety. This warranty does not include reimbursement for inconvenience, loss of use, customer assembly, set-up time, or unauthorized service.

This warranty covers only Heath products and is not extended to other equipment or components that a customer uses in conjunction with our products.

SUCH REPAIR AND REPLACEMENT SHALL BE THE SOLE REMEDY OF THE CUSTOMER AND THERE SHALL BE NO LIABILITY ON THE PART OF HEATH FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO ANY LOSS OF BUSINESS OR PROFITS, WHETHER OR NOT FORSEEABLE.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Owner's Responsibility

EFFECTIVE WARRANTY DATE — Warranty begins on the date of first consumer purchase. You must supply a copy of your proof of purchase when you request warranty service or parts.

ASSEMBLY — Before seeking warranty service, you should complete the assembly by carefully following the manual instructions. Heathkit service agencies cannot complete assembly and adjustments that are customer's responsibility.

ACCESSORY EQUIPMENT — Performance malfunctions involving other non-Heath accessory equipment, (antennas, audio components, computer peripherals and software, etc.) are not covered by this warranty and are the owner's responsibility.

SHIPPING UNITS — Follow the packing instructions published in the assembly manuals. Damage due to inadequate packing cannot be repaired under warranty.

If you are not satisfied with our service (warranty or otherwise) or our products, write directly to our Director of Customer Service, Heath Company, Benton Harbor MI 49022. He will make certain your problems receive immediate, personal attention.

Heathkit® Manual

for the

MONOCHROME VIDEO MONITOR

Model HVM-122A

595-3079-01

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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FCC WARNING

Federal Communications Commission requirements prescribe certification of personal computers and any interconnected peripherals in Part 15 Subpart J of the Rules and Regulations. This computing device will meet these requirements when constructed in strict accordance with the instructions in this Manual, using only components and materials supplied with the kit or the exact equivalent thereof. You will be instructed to sign and date the enclosed FCC ID label and affix the label to the equipment certifying that you have constructed this equipment in accordance with the above mentioned instructions. In order to meet legal requirements, be certain to follow the instructions exactly as they are stated in this Manual.

This equipment has been certified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of the FCC Rules. Only computers certified to comply with the Class B limits may be attached to this equipment. Operation with non-certified computers is likely to result in interference to radio and TV reception.

This equipment generates and uses radio frequency energy for its operation; and if not installed and used properly, that is, in strict accordance with the instruction manual, may cause interference to radio and television reception. It has been type tested and found to comply with the RF emission limits for a Class B computing device which is intended to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which you can determine by turning the equipment off and on, try to correct the interference by one or more of the following measures:

- Move the computing device away from the receiver being interfered with.
- Relocate the computing device with respect to the receiver.
- Reorient the receiving antenna.
- Plug the computing device into a different AC outlet so that the computing device and receiver are on different branch circuits.

- Disconnect and remove any I/O cables that are not being used. (Unterminated I/O cables are a potential source of high RF emission levels.)
- Unplug and remove any serial I/O circuit board cards that are not being used. (Here again, unterminated cards can be a source of potential interference.)
- Be certain that the computing device is plugged into grounded outlet receptacles. (Avoid using AC cheater plugs. Lifting of the power cord ground may increase RF emission levels and may also present a lethal shock hazard to the user.)

If you need additional help, consult your dealer or ask for assistance from the manufacturer. Customer service information is on the inside back cover of this Manual or on an insert sheet supplied with this equipment. You may also find the following booklet helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the US Government Printing Office, Washington, D.C. 20402, Stock No. 004-000-00345-4.

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INTRODUCTION

The Heathkit Model HVM-122A 12" Monochrome Monitor is designed to be used with a computer or terminal that produces an NTSC composite sync signal. The cathode ray tube (CRT) contains an amber phosphor that is very pleasing to the eye.

Black Level (Brightness), contrast, vertical hold, and horizontal hold controls are conveniently located on

the front of the handsomely-styled, compact cabinet. A switch to select either 40 or 80 characters per line is located on the rear of the cabinet.

This Monitor is a welcome addition to any home or office computer system and is designed to provide many years of user satisfaction.

UNPACKING INSTRUCTIONS

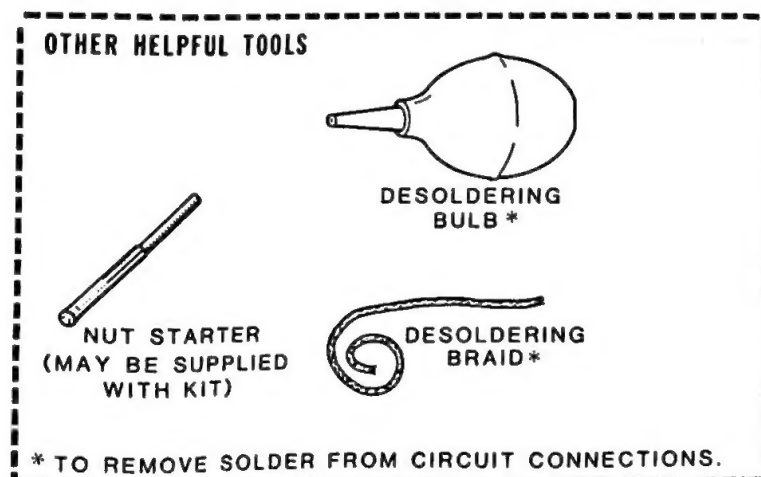
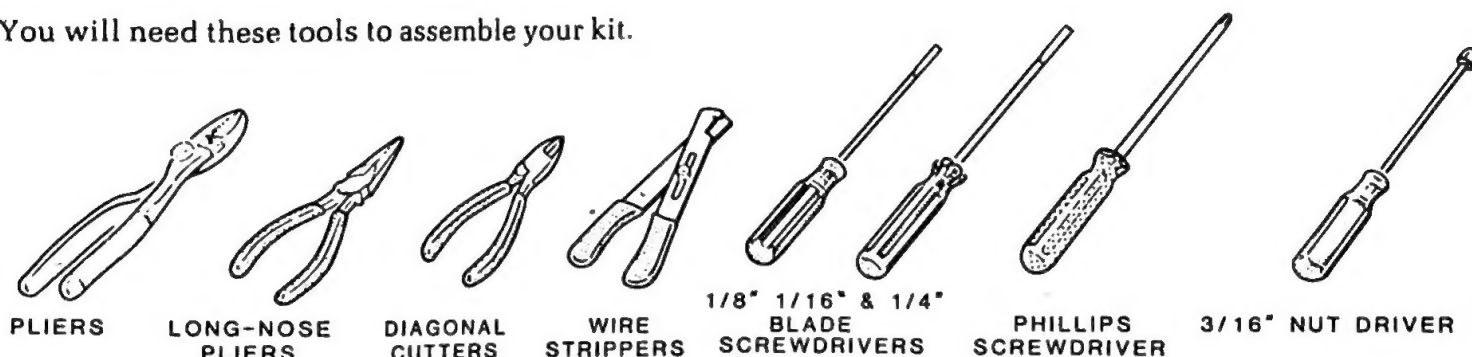
Locate the "Pack Index Sheet" that is packed inside the carton. This sheet identifies the location of each pack. Packs 1 and 2 are in separate compartments and contain the circuit board parts. The remaining parts will be considered the final pack.

The Assembly Manual has three (3) Parts Lists, one for each pack. Each Parts List has its own unpacking instructions that you should read carefully. Never unpack more than one pack at a time.

ASSEMBLY NOTES

TOOLS

You will need these tools to assemble your kit.



ASSEMBLY

1. Follow the instructions carefully. Read the entire step before you perform each operation.
2. The illustrations in the Manual are called Pictorials and Details. Pictorials show the overall operation for a group of assembly steps; Details generally illustrate a single step. When you are directed to refer to a certain Pictorial "for the following steps," continue using that Pictorial until you are referred to another Pictorial for another group of steps.
3. Most kits use a separate "Illustration Booklet" that contains illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. Keep the "Illustration Booklet" with the Assembly Manual. The illustrations in it are arranged in Pictorial number sequence.
4. Position all parts as shown in the Pictorials.
5. Solder a part or a group of parts only when you are instructed to do so.

6. Each circuit part in an electronic kit has its own component number (R2, C4, etc.). Use these numbers when you want to identify the same part in the various sections of the Manual. These numbers, which are especially useful if a part has to be replaced, appear:

— In the Parts List,

— At the beginning of each step where a component is installed,

— In some illustrations,

— In the Schematic,

— In the section at the rear of the Manual.

7. When you are instructed to cut something to a particular length, use the scales (rulers) provided at the bottom of the Manual pages.

SAFETY WARNING: Avoid eye injury when you cut off excessive lead lengths. Hold the leads so they cannot fly toward your eyes.

SOLDERING

Soldering is one of the most important operations you will perform while assembling your kit. A good solder connection will form an electrical connection between two parts, such as a component lead and a circuit board foil. A bad solder connection could prevent an otherwise well-assembled kit from operating properly.

It is easy to make a good solder connection if you follow a few simple rules:

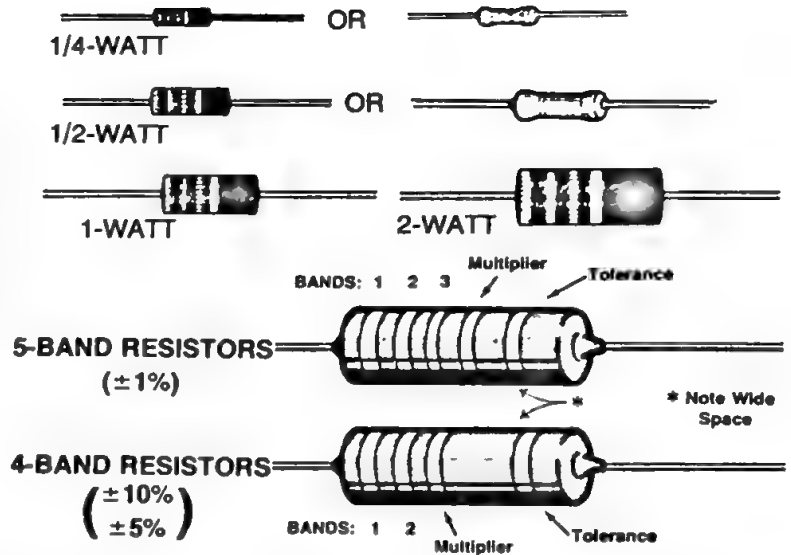
1. Use the right type of soldering iron. A 22 to 25-watt pencil soldering iron with a 1/8" or 3/16" chisel or pyramid tip works best.
2. Keep the soldering iron tip clean. Wipe it often on a wet sponge or cloth; then apply solder to the tip to give the entire tip a wet look. This process is called tinning, and it will protect the tip and enable you to make good connections. When solder tends to "ball" or does not stick to the tip, the tip needs to be cleaned and retinned.

NOTE: Always use rosin core, radio-type solder (60:40 tin-lead content) for all of the soldering in this kit. This is the type we have supplied with the parts. The Warranty will be void and we will not service any kit in which acid core solder or paste has been used.

Heathkit

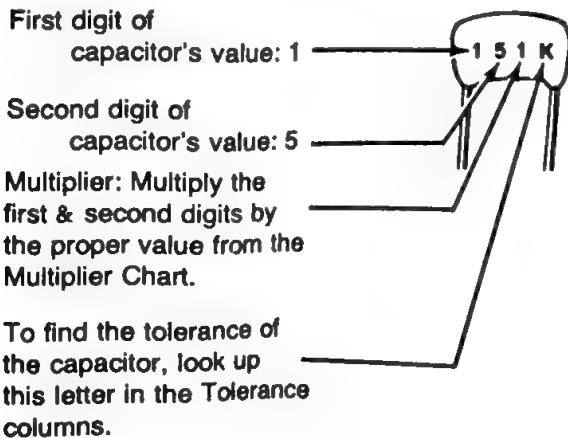
PARTS

Resistors are identified in Parts Lists and steps by their resistance value in Ω (ohms), $k\Omega$ (kilohms), or $M\Omega$ (megohms). They are usually identified by a color code and four or five color bands, where each color represents a number. These colors (except for the last band, which indicates a resistor's "tolerance") will be given in the steps in their proper order. Therefore, the following color code is given for information only. NOTE: Occasionally, a "precision" or "power" resistor may have the value stamped on it.



Band 1 1st Digit		Band 2 2nd Digit		Band 3 (if used) 3rd Digit		Multiplier		Resistance Tolerance	
Color	Digit	Color	Digit	Color	Digit	Color	Multiplier	Color	Tolerance
Black	0	Black	0	Black	0	Black	1	Silver	$\pm 10\%$
Brown	1	Brown	1	Brown	1	Brown	10	Gold	$\pm 5\%$
Red	2	Red	2	Red	2	Red	100	Red	$\pm 2\%$
Orange	3	Orange	3	Orange	3	Orange	1,000	Brown	$\pm 1\%$
Yellow	4	Yellow	4	Yellow	4	Yellow	10,000	Green	$\pm .5\%$
Green	5	Green	5	Green	5	Green	100,000	Blue	$\pm .25\%$
Blue	6	Blue	6	Blue	6	Blue	1,000,000	Violet	$\pm .1\%$
Violet	7	Violet	7	Violet	7	Silver	0.01	Gray	$\pm .05\%$
Gray	8	Gray	8	Gray	8	Gold	0.1		
White	9	White	9	White	9				

Capacitors will be called out by their capacitance value in μF (microfarads) or pF (picofarads) and type: ceramic, Mylar*, electrolytic, etc. Some capacitors may have their value printed in the following manner:



EXAMPLES:

$$151K = 15 \times 10 = 150 \text{ pF}$$

$$759 = 75 \times 0.1 = 7.5 \text{ pF}$$

NOTE: The letter "R" may be used at times to signify a decimal point: as in: 2R2 = 2.2 (pF or μF).

MULTIPLIER		TOLERANCE OF CAPACITOR		
FOR THE NUMBER:	MULTIPLY BY:	10 pF OR LESS	LETTER	OVER 10 pF
0	1	$\pm 0.1 \text{ pF}$	B	
1	10	$\pm 0.25 \text{ pF}$	C	
2	100	$\pm 0.5 \text{ pF}$	D	
3	1000	$\pm 1.0 \text{ pF}$	F	$\pm 1\%$
4	10,000	$\pm 2.0 \text{ pF}$	G	$\pm 2\%$
5	100,000		H	$\pm 3\%$
			J	$\pm 5\%$
8	0.01		K	$\pm 10\%$
9	0.1		M	$\pm 20\%$

*DuPont Registered Trademark

SPECIAL ASSEMBLY NOTES

NOTE: The following suggestions will not necessarily improve the operation of your kit. They will, however, help you troubleshoot it (if it ever becomes necessary), and help you perform the "Circuit Board Checkout" steps at the end of the assembly sections of this Manual. And you will have a more professionally-built kit when you finish.

1. When you install resistors, always position each resistor so you can read the bands on the resistor in the same direction as you can read the printing on the circuit board (see Figure 1). For resistors that have the value printed on them instead of color bands, install these resistors so the values are facing away from the circuit board and read in the same direction as the printing on the circuit board.

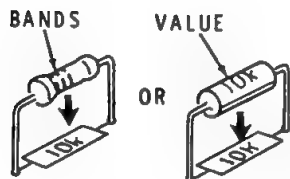


Figure 1

2. When you install ceramic, Mylar, or mica capacitors, always position each capacitor so you can read the value on the capacitor in the same direction as you can read the printing on the circuit board (see Figure 2).

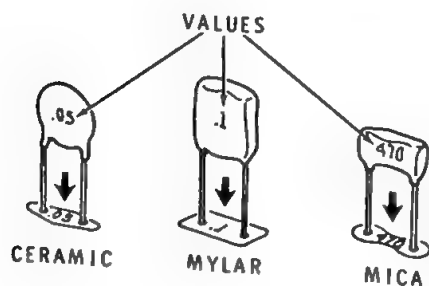


Figure 2

3. When you install electrolytic or other tubular capacitors, always position each capacitor so the value is facing away from the circuit board (see Figure 3). Be sure to observe the correct polarity when you install electrolytic capacitors (as you will be directed in the steps). Other, non-polarized, capacitors should be installed so you can read the values in the same direction as the printing on the circuit board.

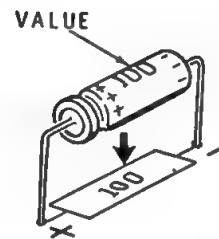


Figure 3

4. Install diodes so the type numbers or part numbers are facing away from the circuit board. Be sure to match the band on one end of each diode with the band mark on the circuit board.

SMALL CIRCUIT BOARDS

PARTS LIST

Unpack Pack #1 and check each part against the following list. Axial lead components (resistors, diodes, and some capacitors) are supplied taped together in a strip. DO NOT remove any taped component from its strip until you use it in a step. After you identify a part that is packed in an envelope with a part Number on it, return the part to the envelope until it is called for in a step. Save all packing material until you have accounted for all of the parts.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with this kit, or refer to "Replacement Parts" inside the rear cover of this Manual. For prices, refer to the separate "Heath Parts Price List."

TAPED COMPONENTS

Refer to the enclosed "Taped Component Chart" and follow the instructions at the top of that chart to check the following components. The parts are taped in the sequence that you will use them during assembly. It is not necessary to check them against the Parts List.

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
-------------------	------	-------------	----------------------

RESISTORS

1/4-Watt, 5%

NOTE: All 5% resistors have a gold fourth band which will not be called out in the following list.

6-270-12	1	27 Ω (red-viol-blk)	R206
6-470-12	1	47 Ω (yel-viol-blk)	R202
6-101-12	1	100 Ω (brn-blk-brn)	R205
6-151-12	1	150 Ω (brn-grn-brn)	R209
6-182-12	1	1800 Ω (brn-gry-red)	R225
6-185-12	1	1.8 M Ω (brn-gry-grn)	R213

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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Resistors (cont'd.)

1/2-Watt, 5%

6-821	1	820 Ω (gry-red-brn)	R201
6-102	2	1000 Ω (brn-blk-red)	R208, R222
6-153	1	15 k Ω (brn-grn-org)	R216
6-333	2	33 k Ω (org-org-org)	R207, R214

NON-TAPED COMPONENTS

The following components are not taped on strips. The key numbers correspond to the numbers on the "Small Circuit Boards Parts Pictorial" (Illustration Booklet, Page 1).

NOTE: Some components may bear a number that differs from the Heath Part Number in the following list. This number may be only part of the number listed in parentheses after the description of the part. Steps for installing these parts will call out the Heath Part Number and the most significant digits of the alternate number.

After you identify a part that is packaged in an envelope, return the part to the envelope until you are told to install it in a step.

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
---------	----------------	------	-------------	-------------------

CONTROLS

✓A1	234-287	1	2 MΩ (#63-10651-14 or 651-14 or 205 M)	R215
✓A1	234-330	1	3000 Ω (3 kΩ #63-9697-28 green)	R519
✓A1	234-331	1	1000 Ω (1 kΩ #63-9697-34 blue)	R815
✓A1	234-332	2	250 kΩ (#63-9697-35 white)	R838, R612
✓A1	234-333	1	300 kΩ (#63-9697-36 red)	R616

CAPACITORS

✓B1	21-22	1	220 pF ceramic (220 K)	C201
✓B1	21-140	1	.001 μF ceramic (.001 M)	C207
✓B2	21-72	2	.005 μF ceramic	CX208, CX209
✓B2	21-802	2	.0047 μF ceramic	C205, C206
✓B3	234-335	1	1 μF electrolytic	C202

DIODE — TRANSISTOR — RESISTOR

✓C1	234-338	1	Diode (#261-02)	CR201
✓C2	234-339	1	Transistor (121-990)	Q201
✓C3	234-415	1	1.2 MΩ (brn-red-grn)	R212

HARDWARE

✓D1	250-1396	2	2-56 x 3/8" screw
✓D2	254-26	2	#2 lockwasher
✓D3	252-51	2	2-56 nut
✓D4	234-391	2	#6 x 5/16" self-tapping screw

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
---------	----------------	------	-------------	-------------------

MISCELLANEOUS

✓E1	234-336	4	Spark gap	E201-E204
✓E2	234-337	1	7-pin socket	S201
✓E3	234-387	1	Width coil	LX506
✓E4	234-397	1	Width coil insulator	
✓E5	234-379	1	Width coil shaft	
✓E6	234-396	1	Width coil plate	
✓E7	260-65	2	Fuse clip	
✓E8	421-29	1	3/4-ampere slow-blow fuse	FX201
✓E9	234-380	1	Jack	J1
✓E10	234-384	1	Jack clip	
✓E11	234-383	1	Slide switch	SW202
✓E12	346-26	7"	Clear tubing	
✓E13	354-5	1	Cable tie	
✓E14	490-5	1	Nut starter	
✓	85-2875-1	1	Video circuit board	
✓	85-2878-1	1	Width circuit board	
✓	85-2877-1	1	Control circuit board	
✓E15	234-412	1	Fuse circuit board	
✓	344-50	2-1/2"	Black wire	
✓	344-54	30"	Yellow wire	
✓	344-58	2-1/2"	Gray wire	
✓	344-70	21-1/2"	White/black wire	
✓	234-369	12"	Yellow/black wire pair	
		1	Solder	
		1	Assembly Manual (See front cover for part number)	
✓	597-260	1	Parts Order form	
✓	597-3390	1	Taped Component Chart	

NOTE: Components identified with an "X" (such as CX208, LX506, etc) are safety rated and must be installed in their specified locations. Should replacement ever become necessary, use only an identical replacement part.



STEP-BY-STEP ASSEMBLY

VIDEO CIRCUIT BOARD

- (✓) Position the video circuit board as shown in Pictorial 1-1 (Illustration Booklet, Page 2).

Refer to Pictorial 1-1 as you read the following notes and steps.

NOTES:

1. Many circuit board drawings, such as the one shown in Pictorial 1-1, are divided into two or more sections. These sections show you which area of the circuit board you are working in for a specific series of steps.
2. Each series of steps has you installing parts in a top-to-bottom, left-to-right sequence. Occasionally, you may be directed to install a particular component in an area out of sequence. These components are each identified in the step and on the Pictorial with a special callout.
3. Check off each step as you perform it. You may also wish to place a check mark near each component on the Pictorial as you install it.
4. In general, solder instructions are given only at the end of a series of similar steps. You may solder more often, if you desire.

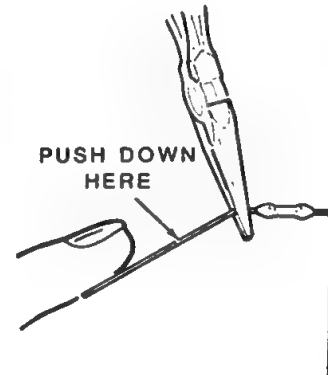
NOTE: Refer to the "Taped Components Chart" before you begin.

In the following steps, you will be given detailed instructions on how to install and solder the first part on the circuit board. Read and perform each step carefully. Then use the same procedure whenever you install parts on a circuit board.

- (✓) Note that some circuit boards have foil on both sides, but only one side has the component outlines shown on it. This side of the circuit board is referred to as the "component side." Position the circuit board as shown in the Pic-

torial with the component side up. Always install components on the component side of the circuit board, and solder the leads to the foil on the other side unless a step specifically directs you otherwise.

- (✓) R202: Hold a 47 Ω (yel-viol-blk) resistor as shown and bend the leads straight down with long-nose pliers to fit the hole spacing on the circuit board.



- (✓) Start the leads into the holes at the resistor's location at the top of Section 1 of the circuit board. The end with color bands may be positioned either way. NOTE: Resistors are identified by the following outline:

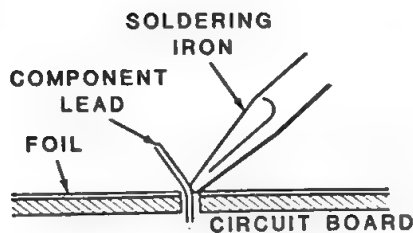


- (✓) Press the resistor against the circuit board. Then bend the leads outward slightly to hold it in place.

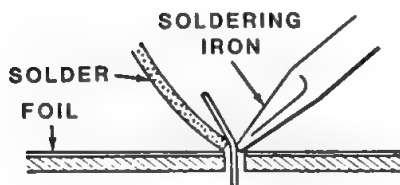


- () Solder the resistor leads to the circuit board as follows:

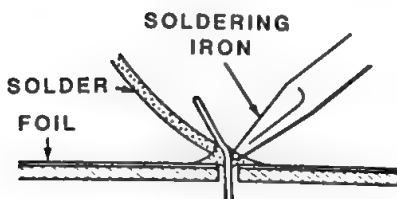
1. Push the soldering iron tip against both the lead and the circuit board foil. Heat both for two or three seconds.



2. Then apply solder to the other side of the connection. IMPORTANT: Let the heated lead and the circuit board foil melt the solder.



3. As the solder begins to melt, allow it to flow around the connection. Then remove the solder and the iron and let the connection cool.



- (✓) Cut off the excess lead lengths close to the connection. WARNING: Clip the leads so the ends will not fly toward your eyes.
- (✓) Check each connection. Compare it to the illustrations on Page 15. After you have checked the solder connections, proceed with the assembly on this page. Use the same soldering procedure for each connection.

Start at the top of Section 1 and install the following resistors. The sequence of the steps matches the locations of the resistors on the circuit board. NOTE: Make sure you installed resistor R202 in an earlier step.

(✓) R209: 150 Ω (brn-grn-brn).

(✓) R206: 27 Ω (red-viol-blk).

(✓) R205: 100 Ω (brn-blk-brn).

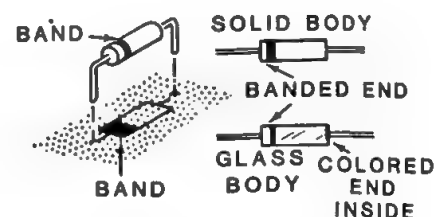
Install resistors and a diode in Section 2 of the circuit board as follows:

(✓) R201: 820 Ω , 1/2-watt (gry-red-brn).

(✓) R208: 1000 Ω , 1/2-watt (brn-blk-red).

(✓) R222: 1000 Ω , 1/2-watt (brn-blk-red).

NOTE: In some of the following steps, you will install diodes. Whenever you install a diode, always match the banded end of the diode with the band mark on the circuit board. A diode will not work properly if it is installed backwards.



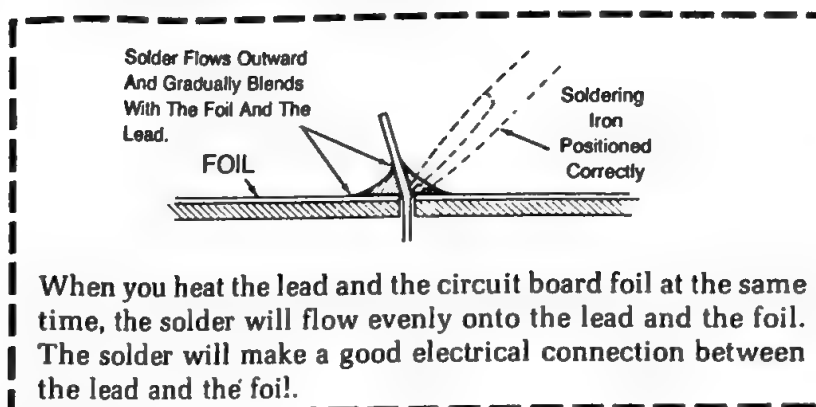
CAUTION: ALWAYS POSITION THE BANDED END OF A DIODE AS SHOWN ON THE CIRCUIT BOARD.

NOTE: A step that begins with a large dot, like the next step, uses a component that is packaged in a small envelope with a part number on it. Locate the envelope and remove (only) the component for the step.

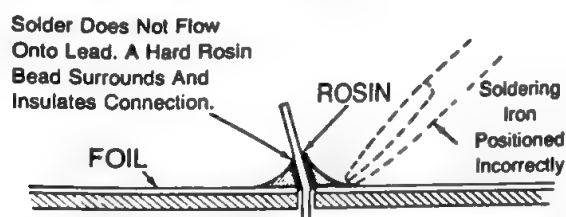
- () •CR201: 261-02 diode (#234-338). NOTE: Diodes are identified on the circuit board by the following outline:



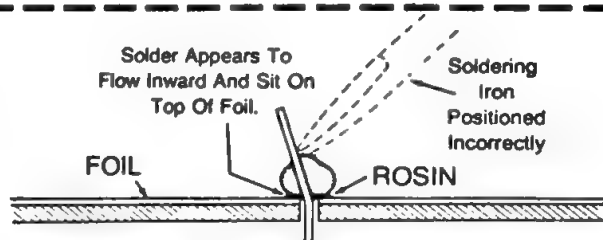
A GOOD SOLDER CONNECTION



POOR SOLDER CONNECTIONS



When the lead is not heated sufficiently, the solder will not flow onto the lead as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.



When the foil is not heated sufficiently the solder will blob on the circuit board as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.

SOLDER BRIDGES

A solder bridge between two adjacent foils is shown in photograph A. Photograph B shows how the connection should appear. A solder bridge may occur if you accidentally touch an adjacent previously soldered connection, if you use too much solder, or if you "drag" the soldering iron across other foils as you remove it from the connection. A good rule to follow is: always take a good look at the foil area around each lead before you solder it. Then, when you solder the connection, make sure the solder remains in this area and does not bridge to another foil. This is especially important when the foils are small and close together. NOTE: It is alright for solder to bridge two connections on the same foil.

Use only enough solder to make a good connection, and lift the soldering iron straight up from the circuit board. If a solder bridge should develop, turn the circuit board foil-side-down and heat the solder between connections. The excess solder will run onto the tip of the soldering iron, and this will remove the solder bridge. NOTE: The foil side of most circuit boards has a coating on it called "solder resist." This is a protective insulation to help prevent solder bridges.



A

SOLDER BRIDGE



B

- (✓) R225: 1800 Ω (brn-gry-red).
- (✓) R216: 15 k Ω , 1/2-watt (brn-grn-org).
- (✓) Solder the leads to the foil and cut off the excess lead lengths. Install the following parts in Section 3 of the circuit board.
- (✓) R207: 33 k Ω , 1/2-watt (org-org-org).
- (✓) R212: 1.2 M Ω (brn-red-grn), 234-415, in envelope.)
- (✓) R213: 1.8 M Ω (brn-gry-grn).
- (✓) R214: 33 k Ω , 1/2-watt (org-org-org).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

Refer to Pictorial 1-2 for the following steps.

NOTE: When you install the following control and socket, make sure the pins are inserted all the way into the board. Then solder them to the foil.

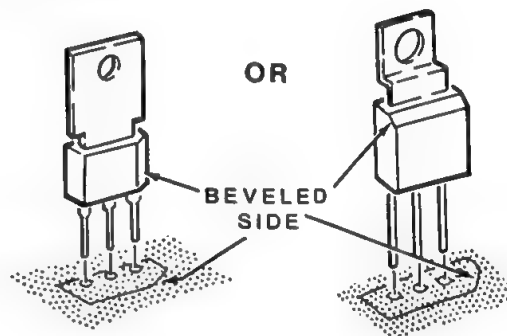
- (✓) R215: 2 M Ω control, 234-287 (651-14).
- (✓) S201: 7-pin socket. NOTE: Make sure the solder does not flow into the pin holes.

Refer to Pictorial 1-3 for the following steps.

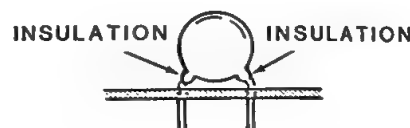
Install a transistor and capacitors in Section 1 of the circuit board as follows. NOTE: These parts are identified on the circuit board by the following outlines.



- (✓) Q201: 990 transistor, 234-339. Match the beveled side of the transistor with the beveled outline on the board. Insert the leads and position the transistor 1/4" away from the board. Solder the leads to the foil and cut off the excess lead lengths.

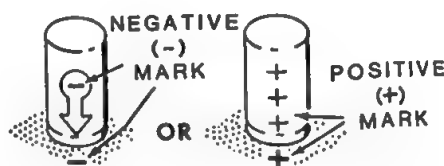


NOTE: In some of the following steps, you will install disc-type ceramic capacitors. When you install these ceramic capacitors, do not push the insulated portion of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil.



- (✓) C201: 220 pF (220 K) ceramic.

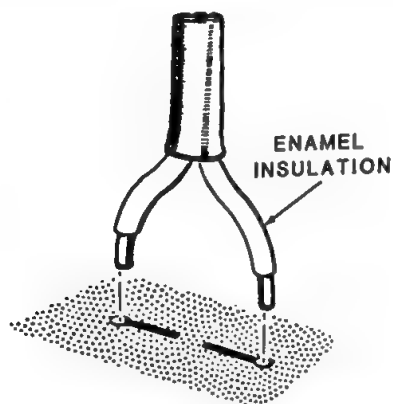
NOTE: In some of the following steps, you will install electrolytic capacitors. Before you install an electrolytic capacitor, look at it and identify the leads. One lead will have a positive (+) mark or a negative (-) mark near it. Be sure to install the positive lead in the positive-marked hole, or the negative lead in the negative-marked hole.



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- (✓) C202: 1 μ F electrolytic.
- (✓) C206: .0047 μ F ceramic.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

Install spark gaps and capacitors in Section 2 of the circuit board as follows. NOTE: The spark gaps, 234-336 are identified on the board by the following outline.



When you install the spark gaps, do not push the insulated portion of the leads into the circuit board holes.

- (✓) E202: Spark gap.
- (✓) E201: Spark gap.
- (✓) E204: Spark gap.
- (✓) E203: Spark gap.
- (✓) C205: .0047 μ F ceramic.
- (✓) C207: .001 μ F ceramic.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

Set this circuit board aside until it is called for later.

WIDTH CIRCUIT BOARD

Refer to Pictorial 2-1 (Illustration Booklet, Page 2) for the following steps.

- (✓) Position the circuit board as shown.

NOTE: When a step directs you to prepare a wire, cut the indicated color to the length specified and remove 1/4" of insulation from each end.

- (✓) Locate the following SMALL wires:

30" yellow	2-1/2" gray
2-1/2" black	21-1/2" white-black

- (✓) Prepare the following wires:

12-3/4" yellow
2-1/2" yellow
1-3/4" black
2-1/2" gray
1-1/4" white-black

Connect one end of these wires to the circuit board in the following steps. Solder each wire to the foil side of the board and cut off the excess wire lengths.

- (✓) White-black to hole WHT/BLK.
- (✓) Black to hole BLK.
- (✓) Gray to hole GRY.
- (✓) 2-1/2" yellow to hole YEL.
- (✓) 12-3/4" yellow to YEL 2.

NOTE: You will have several inches of yellow and white/black wires left over. Save them for later use.

- (✓) Separate both ends of the 12" yellow/black pair of wires 1" and prepare the ends.

Connect one end of these wires to the circuit board in the following steps.

- (✓) Black to hole YOKE.
- (✓) Yellow to hole YEL 1.
- (✓) Fasten the long yellow wire and the yellow and black pair to the circuit board using a cable tie as shown. Pull the tie tight and cut off the excess length.
- () LX505: Install the width coil on the board. Match the slot in the coil base with the outline on the board and insert the leads. (Your coil



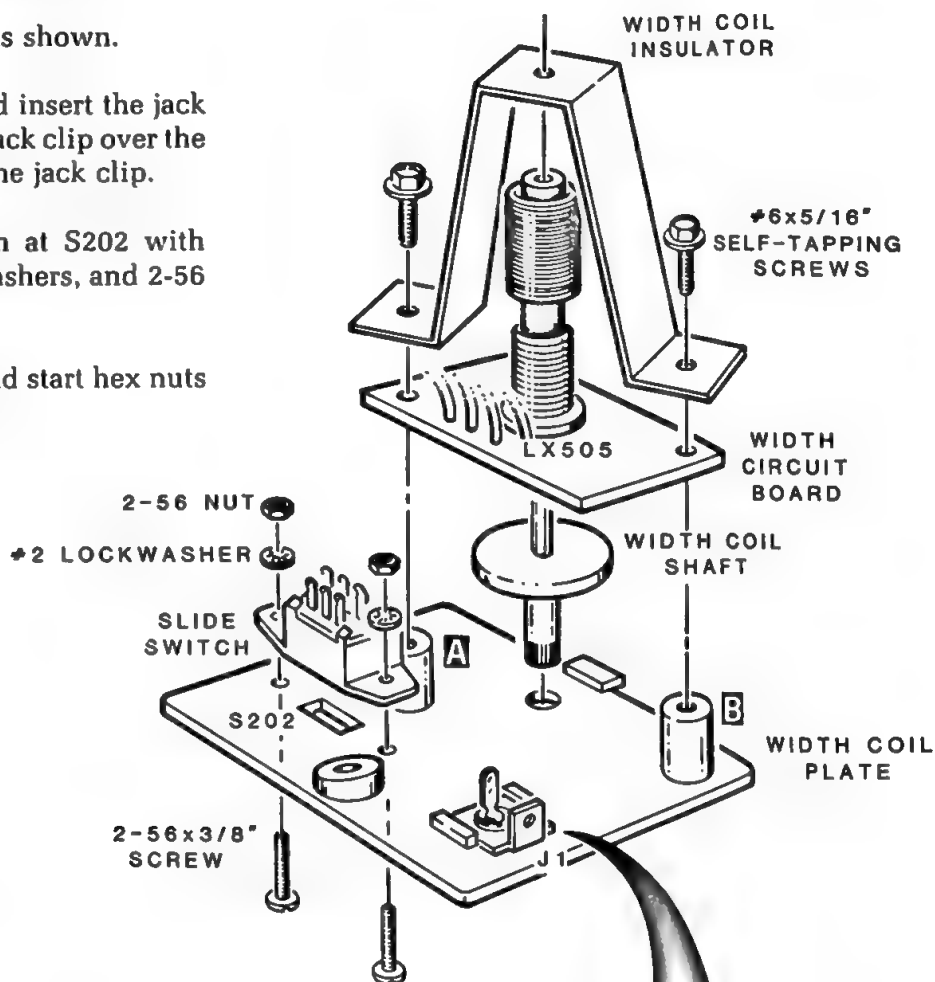
may have only four leads. Be sure to match the slot with the outline). Make sure the coil is against the board and perpendicular to the board. Then solder the leads to the foil and cut off the excess lead lengths.

(✓) Insert the width coil shaft into coil LX505. Then mount the circuit board and width coil insulator on the plate with #6 × 5/16" self-tapping screws at A and B. Make sure the short wires come out toward the switch.

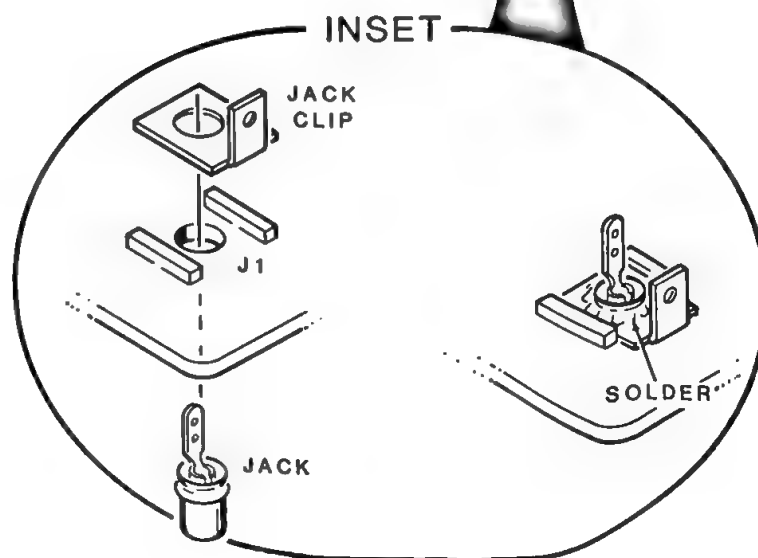
Refer to Pictorial 2-2 for the following steps.

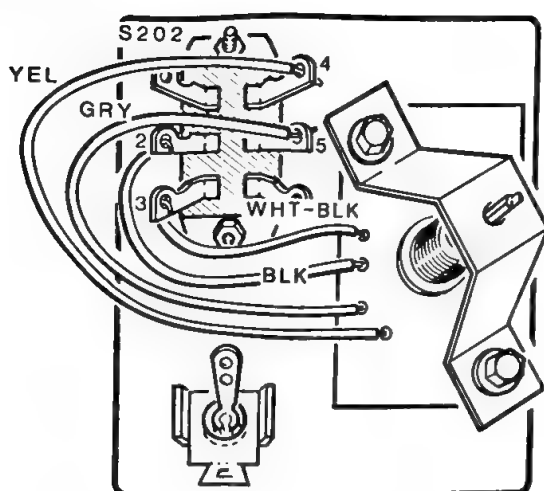
- (✓) Position the width coil plate as shown.
- (✓) Refer to the insert drawing and insert the jack through hole J1 and place the jack clip over the jack. Then solder the jack to the jack clip.
- (✓) S202: Mount the slide switch at S202 with 2-56 × 3/8" screws, #2 lockwashers, and 2-56 nuts.

NOTE: Use the nut starter to hold and start hex nuts and screws in the following steps.



PICTORIAL 2-2





PICTORIAL 2-3

Refer to Pictorial 2-3 for the following steps.

NOTE: In the following steps, (NS) means not to solder the connection because you will add other wires later. "S-" with a number, such as (S-1), means to solder the connection. The number following the "S-" shows you how many wires should be at the connection. This helps you check your work for errors as you go.

Connect the wires coming from the circuit board to switch S202 in the following steps.

- (✓) White-black to lug 3 (S-1).
- (✓) Black to lug 2 (S-1).
- (✓) Yellow to lug 4 (S-1).
- () Gray to lug 5 (S-1).

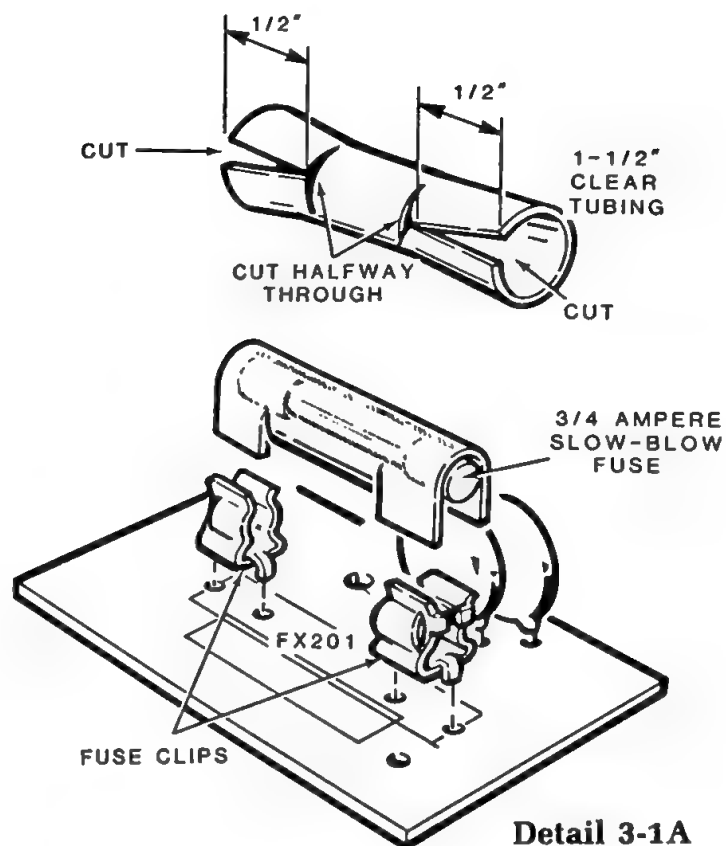
Set this assembly aside until it is called for later.

FUSE CIRCUIT BOARD

Refer to Pictorial 3-1 (Illustration Booklet, Page 2) for the following steps.

- (✓) Position the circuit board as shown.

Install the following components on the board.



Detail 3-1A

- (✓) Use a felt tip pen or marker to change the "4 AMP" in the fuse outline on the board to "3/4 AMP".

Refer to Detail 3-1A for the following steps.

- (✓) Prepare a 1-1/2" length of clear tubing as shown.
- (✓) Place a 3/4-ampere slow-blow fuse inside of the tubing and set it aside temporarily.
- (✓) Position the two fuse clips as shown and insert them into the board at FX201. Install the fuse (do not remove the tubing) into the clips. Then solder the clips to the foil.

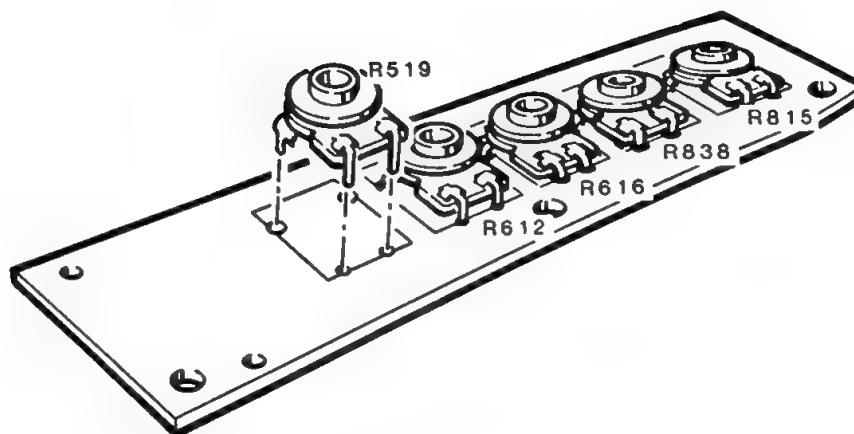
- (✓) CX208: .005 μ F ceramic.

- (✓) CX209: .005 μ F ceramic.

- (✓) Solder the leads to the foil and cut off the excess lead lengths.

Set the circuit board aside until it is called for later.





PICTORIAL 4-1

CONTROL CIRCUIT BOARD

Refer to Pictorial 4-1 for the following steps.

(✓) Position the circuit board as shown.

Mount the following controls on the board. Make sure the tabs seat squarely on the board so the control shafts, that will be installed later, will be parallel with each other. Solder the tabs and lugs of each control to the foil as you mount them.

(✓) R519: 3000 Ω (3 k Ω), 234-330 (697-28 green).

(✓) R612: 250 k Ω , 234-332 (697-35 white).

(✓) R616: 300 k Ω , 234-333 (697-36 red).

(✓) R838: 250 k Ω , 234-332 (697-35 white).

(✓) R815: 1000 Ω (1 k Ω), 234-331 (697-34 blue).

Set this circuit board aside until it is called for later.

MAIN CIRCUIT BOARD

PARTS LIST

Unpack Pack #2 and check each part against the following list. Axial lead components (resistors, diodes, and some capacitors) are supplied taped together in a strip. DO NOT remove any taped component from its strip until you use it in a step. After you identify a part that is packed in an envelope with a part number on it, return the part to the envelope until it is called for in a step. Save all packing material until you have accounted for all of the parts.

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with this kit, or refer to "Replacement Parts" inside the rear cover of this Manual. For prices, refer to the separate "Heath Parts Price List".

TAPED COMPONENTS

Refer to the enclosed "Taped Component Chart" and follow the instructions at the top of that chart to check the following components. The parts are taped in the sequence that you will use them during assembly. It is not necessary to check them against the Parts List.

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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1/4-WATT, 5% RESISTORS

NOTE: 5% resistors have a fourth band of gold.

6-759-12	1	7.5 Ω (viol-grn-gold)	R624
6-470-12	1	47 Ω (yel-viol-blk)	R809
6-560-12	2	56 Ω (grn-blu-blk)	R629, R804
6-101-12	1	100 Ω (brn-blk-brn)	R632
6-121-12	2	120 Ω (brn-red-brn)	R816, R835
6-151-12	2	150 Ω (brn-grn-brn)	R528, R627
6-221-12	5	220 Ω (red-red-brn)	R501, R530, R822, R832, R833

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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Resistors (cont'd.)

6-241-12	1	240 Ω (red-yel-brn)	R814
6-271-12	1	270 Ω (red-viol-brn)	R631
6-331-12	2	330 Ω (org-org-brn)	R620, R703
6-471-12	5	470 Ω (yel-viol-brn)	R610, R701, R802, R805, R806
6-561-12	1	560 Ω (grn-blu-brn)	R829
6-681-12	2	680 Ω (blu-gry-brn)	R803, R823
6-102-12	2	1000 Ω (brn-blk-red)	R710, R813
6-132-12	1	1300 Ω (brn-org-red)	R626
6-152-12	1	1500 Ω (brn-grn-red)	R702

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
Resistors (cont'd.)			
6-222-12	1	2200 Ω (red-red-red)	R502
6-272-12	3	2700 Ω (red-viol-red)	R611, R811, R824
6-332-12	1	3300 Ω (org-org-red)	R851
6-472-12	1	4700 Ω (yel-viol-red)	R807
6-682-12	3	6800 Ω (blu-gry-red)	R801, R831, R852
6-752-12	1	7500 Ω (viol-grn-red)	R826
6-103-12	4	10 k Ω (brn-blk-org)	R503, R523, R609, R618
6-123-12	3	12 k Ω (brn-red-org)	R504, R608 R628
6-153-12	3	15 k Ω (brn-grn-org)	R506, R517, R602
6-223-12	1	22 k Ω (red-red-org)	R705
6-273-12	2	27 k Ω (red-viol-org)	R621, R828
6-473-12	1	47 k Ω (yel-viol-org)	R619
6-104-12	3	100 k Ω (brn-blk-yel)	R505, R518, R520
6-154-12	2	150 k Ω (brn-grn-yel)	R510, R526
6-334-12	2	330 k Ω (org-org-yel)	R603, R808
6-472-12	1	470 k Ω (yel-viol-yel)	R604

HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
Resistors (cont'd.)			
6-624-12	1	620 k Ω (blu-red-yel)	R613
6-105-12	2	1 M Ω (brn-blk-grn)	R614, R827
6-155-12	1	1.5 M Ω (brn-grn-grn)	R606

1% RESISTORS

NOTE: 1% resistors have a fifth band of brown.

6-1321-12	1	1320 Ω 1% (brn-org-red-brn)	R516
6-1781-12	1	1780 Ω 1% (brn-viol-gry-brn)	R514
6-2551-12	1	2550 Ω 1% (red-grn-grn-brn)	R706
6-3651-12	1	3650 Ω 1% (org-blugr-brn)	R707

OTHER RESISTORS

6-820	1	82 Ω 1/2-watt (gry-red-blk)	R522
6-101	1	100 Ω 1/2-watt (brn-blk-brn)	R704
6-681	1	680 Ω 1/2-watt (blu-gry-brn)	RX527
6-682	1	6800 Ω 1/2-watt (blu-gry-red)	R622

DIODES

56-56	1	1N4149 diode	CR707
56-85	1	Diode	CR706

NON-TAPED COMPONENTS

The following components are not taped on strips.
The key numbers correspond to the numbers on the
"Main Circuit Boards Parts Pictorial" (Illustration
Booklet, Page 3).

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
1/4-WATT, 5% RESISTORS				
NOTE: 5% resistors have a fourth band of gold.				
✓A1	234-413	2	1 Ω (brn-blk-gold)	RX524, R623
✓A1	234-346	1	6.8 Ω (blu-gry-gold)	RX521
✓A1	234-347	1	10 Ω (brn-blk-blk)	RX529
✓A1	234-415	2	1.2 M Ω (brn-red-grn)	R525, R607

OTHER RESISTORS

✓A1	234-414	1	9.1 Ω 1/2-watt (wht-brn-gold)	RX711
✓A2	234-348	1	15 Ω 7-watt wire wound (#63-10918-01)	RX712

CERAMIC CAPACITORS

✓B1	21-750	1	56 pF (marked 560)	C811
✓B2	21-22	1	220 pF (221)	C804
✓B2	21-722	1	330 pF (331)	CX512
✓B2	21-56	1	470 pF (471)	C604
✓B3	234-405	1	560 pF (marked 561)	C801

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
Ceramic Capacitors (cont'd.)				
✓B4	21-140	5	.001 μ F (102)	C510, C511, CX513, C515, C805
✓B5	21-164	4	.0015 μ F (152)	C701-C704
✓B6	234-418	5	.0047 μ F (472)	C519, C521, C525, C803, C813
✓B6	21-47	6	.01 μ F (103)	C501, C507, C601, C603, C611, C616
✓B8	234-406	2	.022 μ F (223)	C502, C504
✓B9	21-182	1	.047 μ F (473)	C524

POLYSTYRENE AND MYLAR® CAPACITORS

✓C1	29-18	1	.0056 μ F (5600 pF) polystyrene	C508
✓C2	234-402	2	.022 μ F Mylar	C503, C613
✓C2	234-403	1	.027 μ F Mylar (273)	CX514
✓C2	234-399	1	.047 μ F, 50 V, Mylar	C802
✓C2	234-404	2	.1 μ F Mylar	C606, C608

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KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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ELECTROLYTIC CAPACITORS

✓D1	25-900	3	1 μ F	C506, C509, C615
✓D1	234-408	1	4.7 μ F	C518
✓D1	25-917	3	10 μ F, 25 V	C607, C609, C709
✓D2	234-284	2	10 μ F, 25 V, (NP)	C516, C520
✓D1	234-401	1	10 μ F, 50 V	CX706
✓D1	25-927	4	22 μ F	C617, C808, C809, C814
✓D1	25-884	1	47 μ F	C618
✓D1	25-918	1	100 μ F, 10 V	C810
✓D1	25-885	1	100 μ F, 35 V	C522
✓D1	25-942	4	220 μ F	C523, C614, CX708, CX711
✓D1	25-905	1	470 μ F	C517
✓D2	234-417	1	2200 μ F	CX707

DIODES

✓E1	57-42	4	3A1 diode	CR701-CR704
✓E1	234-299	11	Diode (#103-142-01)	CR501, CR509, CR601 - CR605, CR705, CR801, CR804, CR805
✓E1	234-338	3	Diode (#103-261-02A)	CR502, CR503, CR506
✓E1	234-351	2	Diode (#103-263A)	CR507, CR508
✓E1	234-353	1	Diode (#103-295-03A)	CR505
✓E1	234-354	1	Diode (#103-295A)	CR504

TRANSISTORS

✓F1	234-270	2	121-819 or 121-825 transistor	Q501, Q607
✓F1	234-272	1	121-1036 transistor	Q606
✓F1	234-274	2	121-699 transistor	Q601, Q602
✓F1	234-275	1	121-975 or 121-888 transistor	Q603
✓F1	234-358	1	121-699-01 transistor	Q807
✓F1	234-359	1	121-819 transistor	Q604
✓F1	234-360	4	121-895 transistor	Q801, Q802, Q805, Q806
✓F2	234-362	1	121-1039 transistor	QX502

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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Transistors (cont'd.)

NOTE: The following transistors are marked for identification in one of the following four ways:

1. Part number.
2. Type number.
3. Part number and type number.
4. Part number with a type number other than the one listed.

✓F1	417-864	1	MPS-A05 transistor	Q702
✓F1	417-235	1	2N4121 transistor	Q701
✓F2	417-298	1	TIP41B transistor	Q703

INTEGRATED CIRCUIT

✓F3	234-368	1	221-141	IC501
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TRANSFORMERS — CHOKES

✓G1	234-350	1	Horizontal driver transformer	T501
G2	234-398	1	Flyback transformer (In Final Pack)	TX502
✓G3	234-342	1	Choke	LX508
✓G4	234-343	1	Choke	LX504
✓G5	234-344	1	Choke	LX503

MISCELLANEOUS

✓H1	234-355	2	#6 x 1/4" self-tapping screw	
✓H2	234-391	2	#6 x 5/16" self-tapping screw	
✓H3	250-410	2	#8 x 1/2" self-tapping screw	
✓H4	234-341	2	Transistor clamp	
✓H5	234-363	1	Heat sink (126-2000)	
✓H6	234-364	1	Heat sink (126-2108)	
✓H7	260-65	2	Fuse clip	
✓H8	234-366	1	2-1/4 ampere fuse	FX701
✓H9	234-367	2	Transistor insulator	
✓H10	352-31	1	Thermal compound	
✓H11	434-230	1	8-pin integrated circuit socket	
	85-2876-2	1	Main circuit board	

✓ 75-715 1 1-13/16" x 1-15/32" paper insulator

STEP-BY-STEP ASSEMBLY

Refer to Pictorial 5-1 (Illustration Booklet, Page 4) for the following steps.

Position the circuit board as shown and install resistors, diodes, and jumper wires in Section 1 of the circuit board as follows: Be careful that no bare wires or leads touch the foil on the component side of the board.

NOTE: All resistors are 1/4-watt, 5% unless specified otherwise.

- (✓) R827: 1 M Ω (brn-blk-grn).
- (✓) R828: 27 k Ω (red-viol-org).
- (✓) R829: 560 Ω (grn-blu-brn).
- (✓) R835: 120 Ω (brn-red-brn).
- (✓) R710: 1000 Ω (brn-blk-red).
- (✓) R833: 220 Ω (red-red-brn).
- () R831: 6800 Ω (blu-gry-red).

NOTE: When a jumper wire is called for in a step, use the remaining length of small yellow wire that was left over from the width board. Cut the wires to the length specified in the steps and remove 1/4" of insulation from the ends.

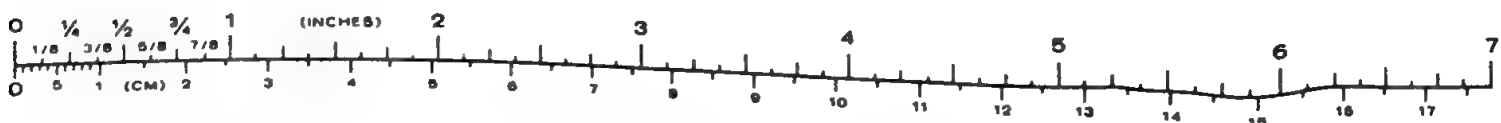
- (✓) 7/8" jumper wire at J.
- (✓) R609: 10 k Ω (brn-blk-org).
- (✓) R631: 270 Ω (red-viol-brn).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

Remember: A large dot preceding a step (as in the next step) indicates that the component is packaged in an envelope with the part number on it.

- (✓) •CR604: 234-299 (142-01) diode NOTE: When you install diodes, be sure to match the band on the diode with the band on the circuit board outline.



- (✓) •CR801: 234-299 (142-01) diode.
- (✓) R629: 56 Ω (grn-blu-blk).
- (✓) R628: 12 k Ω (brn-red-org).
- (✓) •R623: 234-413, 1 Ω (brn-blk-gld).
- (✓) •CR603: 234-299 (142-01) diode.
- (✓) R627: 150 Ω (brn-grn-brn).
- (✓) R618: 10 k Ω (brn-blk-org).
- (✓) •CR602: 234-299 (142-01) diode.
- (✓) R619: 47 k Ω (yel-viol-org).
- (✓) •CR605: 234-299 (142-01) diode.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.
- (✓) R626: 1300 Ω (brn-org-red).
- (✓) R610: 470 Ω (yel-viol-brn).
- (✓) R614: 1 M Ω (brn-blk-grn).
- (✓) R613: 620 k Ω (blu-red-yel).
- (✓) R624: 7.5 Ω (viol-grn-gld).
- (✓) •R607: 234-415, 1.2 M Ω (brn-red-grn).
- (✓) R611: 2700 Ω (red-viol-red).
- (✓) R620: 330 Ω (org-org-brn).



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(✓) R621: 27 k Ω (red-viol-org).

(✓) R608: 12 k Ω (brn-red-org).

() Solder the leads to the foil and cut off the excess lead lengths.

Install the following parts in Section 2 of the circuit board.

(✓) R826: 7500 Ω (viol-grn-red).

(✓) R822: 220 Ω (red-red-brn).

(✓) •CR804: 234-299 (142-01) diode.

(✓) R801: 6800 Ω (blu-gry-red).

(✓) R832: 220 Ω (red-red-brn).

(✓) R824: 2700 Ω (red-viol-red).

(✓) R823: 680 Ω (blu-gry-brn).

(✓) R851: 3300 Ω (org-org-red).

(✓) R852: 6800 Ω (blu-gry-red).

(✓) R622: 6800 Ω , 1/2-watt (blu-gry-red). NOTE: The outline on the board for this resistor will be the size of a 1/4-watt and not a 1/2-watt.

(✓) 7/8" jumper wire at J.

(✓) R632: 100 Ω (brn-blk-brn).

(✓) R602: 15 k Ω (brn-grn-org).

(✓) R704: 100 Ω , 1/2-watt (brn-blk-brn).

(✓) R606: 1.5 M Ω (brn-grn-grn).

(✓) R603: 330 k Ω (org-org-yel).

(✓) R604: 470 k Ω (yel-viol-yel).

(✓) •CR601: 234-299 (142-01) diode.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

Install the following parts in Section 3 of the circuit board.

(✓) R813: 1000 Ω (brn-blk-red).

(✓) R803: 680 Ω (blu-gry-brn).

(✓) R802: 470 Ω (yel-viol-brn).

(✓) R816: 120 Ω (brn-red-brn).

(✓) R814: 240 Ω (red-yel-brn).

(✓) R804: 56 Ω (grn-blu-blk).

(✓) 1" jumper wire at J.

(✓) R702: 1500 Ω (brn-grn-red).

(✓) R705: 22 k Ω (red-red-org).

(✓) 7/8" jumper wire at J.

(✓) R701: 470 Ω (yel-viol-brn).

(✓) R703: 330 Ω (org-org-brn).

(✓) •CR705: 234-299 (142-01) diode.

(✓) CR706: 5 V zener (#56-85) diode.

(✓) 1-1/4" jumper wire at J.

(✓) R706: 2550 Ω , 1% (red-grn-grn-brn).

(✓) R707: 3650 Ω , 1% (org-blu-grn-brn).

(✓) 1" jumper wire at J.

(✓) CR707: 1N4149 (#56-56) diode.

(✓) •RX711: 234-414, 9.1 Ω , 1/2-watt (wht-brn-gld).

() Solder the leads to the foil and cut off the excess lead lengths.

Install the following parts in Section 4 of the circuit board.

- (✓) •CR805: 234-299 (142-01) diode.
- (✓) R805: 470 Ω (yel-viol-brn).
- (✓) R808: 330 k Ω (org-org-yel).
- (✓) R811: 2700 Ω (red-viol-red).
- (✓) R807: 4700 Ω (yel-viol-red).
- (✓) R806: 470 Ω (yel-viol-brn).
- (✓) R809: 47 Ω (yel-viol-blk).
- (✓) •CR505: 234-353 (295-03A) diode.
- (✓) R503: 10 k Ω (brn-blk-org).
- (✓) •CR509: 234-299 (142-01) diode.
- (✓) R504: 12 k Ω (brn-red-org).
- (✓) •RX529: 234-347, 10 Ω (brn-blk-blk).
- (✓) RX527: 680 Ω , 1/2-watt (blu-gry-brn).
- (✓) •CR506: 234-338 (261-02A) diode.
- (✓) •CR507: 234-351 (263-A) diode.
- (✓) •CR508: 234-351 (263-A) diode.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

Install the following parts in Section 5 of the circuit board.

- (✓) R530: 220 Ω (red-red-brn).
- (✓) R505: 100 k Ω (brn-blk-yel).
- (✓) R517: 15 k Ω (brn-grn-org).

- (✓) R518: 100 k Ω (brn-blk-yel).
- (✓) R510: 150 k Ω (brn-grn-yel).
- (✓) R520: 100 k Ω (brn-blk-yel).
- (✓) •R525: 234-415, 1.2 M Ω (brn-red-grn).
- (✓) R506: 15 k Ω (brn-grn-org).
- (✓) R526: 150 k Ω (brn-grn-yel).
- (✓) R502: 2200 Ω (red-red-red).
- (✓) R501: 220 Ω (red-red-brn).
- (✓) •RX521: 234-346, 6.8 Ω (blu-gry-gld).
- (✓) •CR502: 234-338 (261-02A) diode.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

Install the following parts in Section 6 of the circuit board.

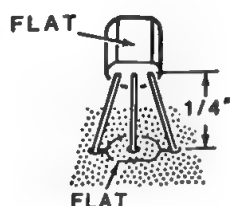
- (✓) R516: 1320 Ω , 1% (brn-org-red-brn).
- (✓) R514: 1780 Ω , 1% (brn-viol-gry-brn).
- (✓) R528: 150 Ω (brn-grn-brn).
- (✓) •CR504: 234-354 (295-A) diode.
- (✓) •CR501: 234-299 (142-01) diode.
- (✓) •RX524: 234-413, 1 Ω (brn-blk-gld).
- (✓) R523: 10 k Ω (brn-blk-org).
- (✓) R522: 82 Ω , 1/2-watt (gry-red-blk).
- (✓) •CR503: 234-338 (261-02A) diode.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

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Refer to Pictorial 5-2 (Illustration Booklet, Page 5) for the following steps.

Install transistors in Section 1 of the circuit board as follows. Do not remove a transistor from its envelope until you are ready to install it in a step.

NOTE: To install a transistor, position it so the flat side matches the flat side of the outline on the circuit board. Then start the leads into their corresponding holes in the board. Position the transistor 1/4" above the board, solder the leads to the foil, and cut off the excess lead lengths.



(✓) Q806: 234-360 (895).

(✓) Q805: 234-360 (895).

(✓) Q807: 234-358 (699-01). Be sure you do not confuse the location with the Q607 that follows.

(✓) Q607: 234-270 (819).

(✓) Q604: 234-359 (819-01).

(✓) Q606: 234-272 (1036).

(✓) Q603: 234-275 (975).

(✓) Q602: 234-274 (699).

(✓) Q601: 234-274 (699).

Install transistors and an IC socket in Section 2 of the circuit board as follows:

(✓) Q801: 234-360 (895).

(✓) Q802: 234-360 (895).

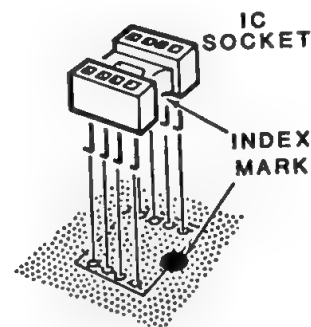
(✓) Q701: 2N4121 (417-235).

(✓) Q702: MPSA05 (417-864).

(✓) Q501: 234-270 (819).

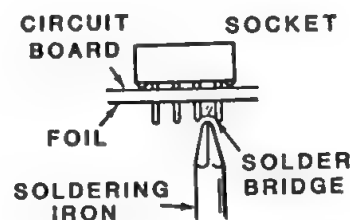
NOTES:

1. In the following step, you will install an IC socket. To install an IC socket, make sure the pins are straight. Then start the pins into the circuit board holes. The index mark on the circuit board must still be visible after you install the socket. Solder the pins to the foil as you install each socket.



2. It is very easy to form a solder bridge between foils when you install an IC socket. After you install each socket, carefully inspect the foil for solder bridges and remove any that you find as described below. If you suspect that you have a solder bridge, but are not positive, you can check your foil pattern against the one shown in the X-Ray View (Illustration Booklet, Page 8).

To remove a solder bridge, hold the circuit board component-side-up as shown and hold your soldering iron tip between the two points that are bridged. The solder will flow down the soldering iron tip.

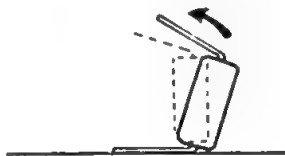


- (✓) U501: Integrated circuit 234-368 (#221-141).
Use the procedure shown in Detail 5-2A for installation.

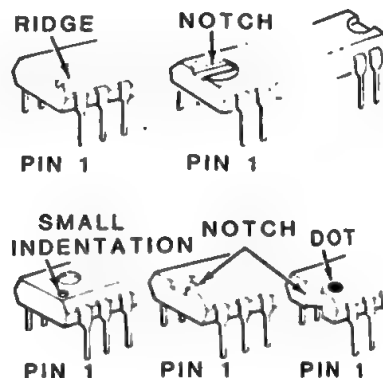
The pins on the IC's may be bent out at an angle, so they do not line up with the holes in the IC socket. DO NOT try to install an IC without first bending the pins as described below. To do so may damage the IC pins or the socket, causing intermittent contact.



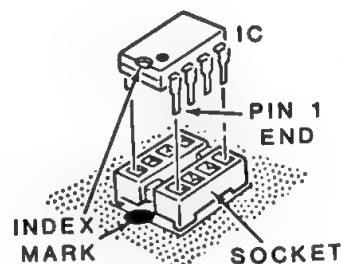
Before you install an IC, lay it down on its side as shown below and very carefully roll it toward the pins to bend the lower pins into line. Then turn the IC over and bend the pins on the other side in the same manner.



Compare the IC to the drawing shown below. Then determine which end of the IC is the pin 1 end.



Position the pin 1 end of the IC over the index mark on the circuit board. Then start the IC pins into the socket. Make sure that all of the pins are started into the socket. Then push the IC firmly into the socket. NOTE: An IC pin can become bent under the IC and it will appear as though it is correctly installed in the socket.



Detail 5-2A

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Refer to Pictorial 5-3 (Illustration Booklet, Page 6) for the following steps.

Install ceramic and mica capacitors in Section 1 of the circuit board as follows.

- (✓) C805: .001 μ F ceramic.
- (✓) C813: 234-418, .0047 μ F (472) ceramic.
- (✓) C601: .01 μ F (103) ceramic.
- (✓) C603: .01 μ F (103) ceramic.
- (✓) C616: .01 μ F (103) ceramic.
- (✓) C613: 234-402, .022 μ F Mylar.
- (✓) C608: .1 μ F Mylar.
- (✓) C611: .01 μ F (103) ceramic.
- (✓) C606: .1 μ F Mylar.
- (✓) C604: 470 pF (471) ceramic.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

Install the following parts in Section 2 of the circuit board as follows:

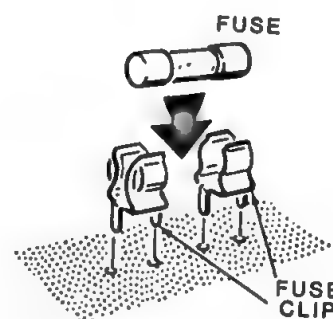
- (✓) C811: 56 pF ceramic. NOTE: This capacitor may be marked 560.
- (✓) C801: 234-405, 560 pF (561) ceramic.
- (✓) C802: 234-399, .047 μ F Mylar.
- (✓) C803: 234-418, .0047 μ F (472) ceramic.
- (✓) C804: 220 pF (221) ceramic.
- (✓) C703: .0015 μ F ceramic.
- (✓) C704: .0015 μ F ceramic.
- (✓) C702: .0015 μ F ceramic.
- (✓) C701: .0015 μ F ceramic.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

NOTE: Do not shorten the leads of the following diodes before you install and solder them. When you install these diodes, install them vertically and position the banded end as shown. Solder the leads to the foil and cut off the excess lead lengths.



- (✓) CR703: 3A1 (#57-42).
- (✓) CR704: 3A1 (#57-42).
- (✓) CR702: 3A1 (#57-42).
- (✓) CR701: 3A1 (#57-42).

- (✓) FX701: Position the two fuse clips as shown and insert them into the board. Install the 2-1/4-ampere fuse into the clips. Then solder the clips to the foil.



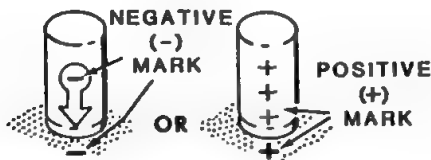
- (✓) C525: 234-418, .0047 μ F (472) ceramic.
- (✓) C521: 234-418, .0047 μ F (472) ceramic.
- (✓) LX504: 234-343 choke.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

Install the following parts in Section 3 of the circuit board.

- (✓) C508: 5600 pF polystyrene. Position the shaded end of the capacitor toward the band of the outline on the board.
- (✓) C510: .001 μ F ceramic.
- (✓) C502: 234-406, .022 μ F ceramic.
- (✓) C504: 234-406, .022 μ F ceramic.
- (✓) C503: 234-402, .022 μ F Mylar.
- (✓) C507: .01 μ F (103) ceramic.
- (✓) C519: 234-418, .0047 μ F (472) ceramic.
- (✓) C501: .01 μ F (103) ceramic.
- (✓) C515: .001 μ F ceramic.
- (✓) CX512: 330 pF (331) ceramic.
- (✓) C511: .001 μ F ceramic.
- (✓) CX513: .001 μ F ceramic.
- (✓) C524: .047 μ F (473) ceramic.

Refer to Pictorial 5-4 (Illustration Booklet, Page 7) for the following steps.

NOTE: In the following steps, you will install electrolytic capacitors. Before you install an electrolytic capacitor, look at it and identify the leads. One lead will have a positive (+) mark or a negative (-) mark near it. Be sure to install the positive lead in the positive-marked hole, or the negative lead in the negative-marked hole.



Install the following parts in Section 1 of the circuit board.

- (✓) C810: 100 μ F, 10 V.
- (✓) C808: 22 μ F.
- (✓) C809: 22 μ F.
- (✓) C814: 22 μ F.
- (✓) C617: 22 μ F.
- (✓) C618: 47 μ f.
- (✓) C614: 220 μ F.
- (✓) C609: 10 μ F, 25 V. Do not use a 10 μ F NP capacitor.
- (✓) C615: 1 μ F.
- (✓) C607: 10 μ F, 25 V (not NP).
- (✓) C709: 10 μ F, 25 V (not NP).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.

Install the following parts in Section 2 of the circuit board.

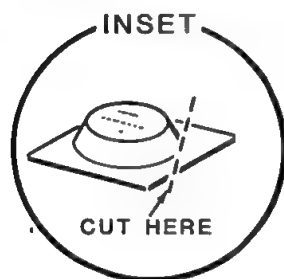
- (✓) C522: 100 μ F, 35 V.
- (✓) CX711: 220 μ F.
- (✓) CX708: 220 μ F.
- (✓) CX706: 234-401, 10 μ F, 50 V.
- (✓) C517: 470 μ F.
- (✓) C523: 220 μ F.
- (✓) Remove 1/4" of insulation from the ends of a 2-1/2" yellow wire. Then install this wire between J2 and J2.
- (✓) In the same manner, prepare and install a 5" yellow wire between J1 and J1.
- (✓) Solder the leads to the foil and cut off the excess lead lengths.



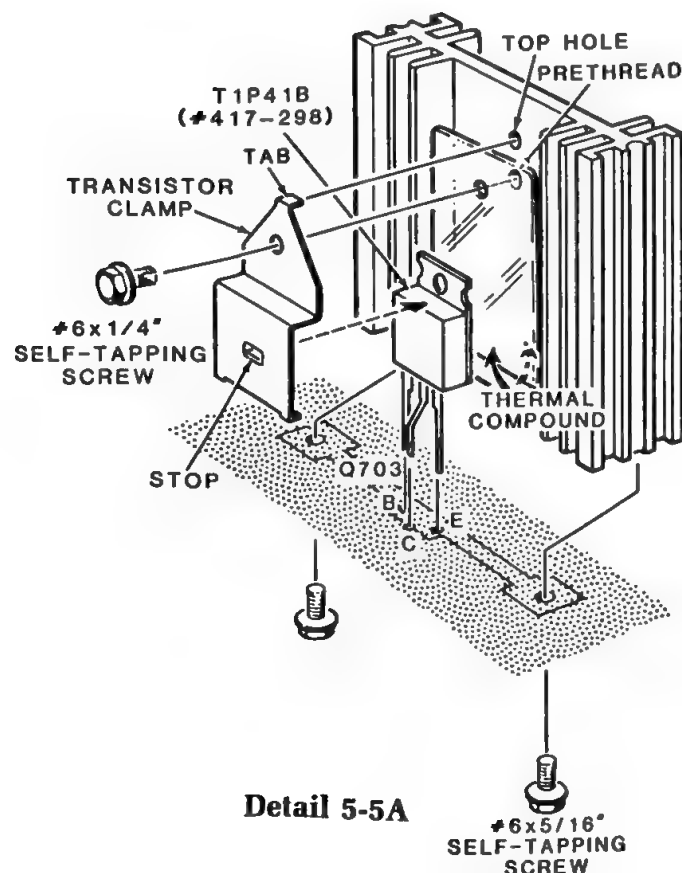
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Install the following parts in Section 3 of the circuit board.

- (✓) C509: 1 μ F electrolytic.
- (✓) C506: 1 μ F electrolytic.
- (✓) C518: 4.7 μ F electrolytic.
- (✓) T501: Horizontal driver transformer. This transformer can be installed only one way.
- (✓) LX508: 234-342 choke. This choke can be installed either way.
- (✓) CX514: .027 μ F Mylar (273).
- (✓) Solder the leads to the foil and cut off the excess lead lengths.



HEAT SINK
(126-2108)



Refer to Pictorial 5-5 (Illustration Booklet, Page 8) for the following steps.

Install the following parts in Section 1 of the circuit board.

- (✓) RX712: 234-348, 15 Ω 7-watt wire-wound resistor (63-10918-01). Solder both leads to the foil.

Refer to Detail 5-5A for the following steps.

- (✓) Locate heat sink 234-364 (2108). Position it as shown and prethread the second hole with a #6 \times 1/4" self-tapping screw. Then set the heat sink aside temporarily.

NOTE: The thermal compound you will use in the following step is not caustic. However, make sure you do not get it in your eyes, ears, nose, mouth, or on your clothing. Wash your hands after you use the compound. Keep this and all chemicals out of the reach of children.

- (✓) Q703: Locate the TIP41B (#417-298) transistor, transistor insulator, transistor clamp, and container of thermal compound. Refer to the inset drawing and open the container of compound. Then spread a thin layer of compound on both sides of the insulator. Place the insulator on the heat sink (the side you prethreaded) lining up the hole in the insulator with the prethreaded hole.

- (✓) Position the transistor clamp as shown and insert the tab in the top hole of the heat sink. Then position the transistor so the metal side is against the insulator and slide it under the transistor clamp to the stop on the clamp. Fasten the clamp with a #6 \times 1/4" self-tapping screw. The screw does not pass through the hole in the transistor.

- (✓) Place the heat sink on the circuit board, at the same time inserting the transistor leads into holes B, C, and E at Q703. Bend the collector lead as shown. Fasten the heat sink to the board with two #6 \times 5/16" self-tapping screws.

- (✓) Solder the three transistor leads to the foil side of the board and cut off the excess lead lengths. Also, solder the collector (C) lead to the foil on the COMPONENT side of the board.

- (✓) CX707: Refer back to Pictorial 5-5 and install a 2200 μ F electrolytic capacitor. Solder the leads to the foil and cut off the excess lead lengths.

Install the following parts in Section 2 of the circuit board.

NOTE: The next two capacitors can be installed either way.

- (✓) C520: 10 μ F, 25 V, (NP) electrolytic.
 - (✓) C516: 10 μ F, 25 V, (NP) electrolytic.
 - (✓) LX503: Choke (#234-344). Be sure to match the colored dot on the choke with the outline on the board. NOTE: When you insert the leads you may have to gently pull them through the holes so the choke seats on the board.
 - (✓) Solder the leads to the foil and cut off the excess lead lengths.
- Refer to Detail 5-5B (Illustration Booklet, Page 8) for the following steps.
- (✓) Locate heat sink 234-363 (2000) and prethread the second hole with a #6 \times 1/4" self-tapping screw. NOTE: Prethread this hole from the smooth side. Then set the heat sink aside temporarily.
 - (✓) QX502: Locate the 234-362 (1039) transistor, transistor insulator, transistor clamp, and the thermal compound. Spread a thin layer of compound on both sides of the insulator. Place the insulator on the heat sink (the side you prethreaded) lining up the hole in the insulator with the prethreaded hole.

- (✓) Now install the transistor using the same method that you used when you installed the other transistor. Fasten the clamp with a #6 \times 1/4" self-tapping screw.

- (✓) Place the heat sink on the circuit board, at the same time inserting the transistor leads into holes B, C, and E at QX-502 and the heat sink into its mounting holes. Solder the heat sink to the foil side of the board keeping it vertical. Then solder the transistor leads to the foil and cut off the excess lengths. NOTE: Scrape away the solder resist coating from around the heat sink mounting holes before soldering.

- (✓) Using sharp scissors cut out the template in Detail 5-5C (Illustration Booklet, Page 8). Tape the template onto the top (dark side) of the 1-13/16" \times 1-15/32" paper insulator.

- (✓) Cut the nine notches into the template and insulator exactly as outlined. Remove the template from the insulator.

- (✓) Fit the insulation onto the bottom seven pins and two holes. Enlarge the notches very slightly if necessary.

- (✓) Remove the white paper backing from the insulator and press the insulator onto the circuit board outline at TX 502, making sure all nine holes are exposed as shown in Detail 5-5D.

- (✓) TX502: Insert the flyback transformer leads into their respective holes in the board and fasten it with two #8 \times 1/2" self-tapping screws. Then solder the leads to the foil. See Detail (Illustration Booklet Page 8) 5-5D.

FINAL WIRING AND COMPONENT MOUNTING

PARTS LIST

Check the parts in Pack #3 and in the Final Pack against the following list. After you identify parts that are packaged in envelopes, return them to their envelopes until you are instructed to use them. Key numbers in the following list correspond with the key numbers on the "Final Wiring and Component Mounting" Parts Pictorial (Illustration Booklet, Page 9).

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.	KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
HARDWARE					Miscellaneous (cont'd.)				
✓A1	234-390	2	#4 x 5/16" self-tapping screw		✓B3	234-375	1	Cabinet door	
✓A2	234-388	1	#6 x 1/2" self-tapping screw		✓B4	234-381	1	CRT spring	
✓A3	234-393	1	#6 x 3/8" self-tapping screw		✓B5	475-12	2	Ferrite bead (large)	FB701, FB702
✓A4	234-391	3	#6 x 5/16" self-tapping screw		✓B6	475-16	2	Ferrite bead (small)	FB1, FB2
✓A5	234-356	6	#8 x 5/16" self-tapping screw		✓B7	21-744	1	82 pF (820) ceramic capacitor	C1
✓A6	234-426	2	#8 x 1/2" self-tapping screw		✓B8	234-410	1	Wire insulator	
✓A7	234-389	1	#8 x 5/8" self-tapping screw (phillips head)		✓B9	73-92	1	Foam tape	
✓A8	234-394	2	#8 x 5/8" self-tapping screw (hex head)		B10	75-109	1	Insulator paper	
✓A9	259-1	3	#6 solder lug		✓B11	234-365	1	Metal shield	
MISCELLANEOUS					✓B12	234-372	1	Switch bracket	
✓B1	234-385	1	Power transformer with bracket	TX201	✓B13	234-382	1	Power switch	
✓B2	234-386	1	Deflection yoke	TX202	✓B14	234-377	1	Switch knob	
	234-431	1	CRT and cabinet (assembly) Consisting of:	VX201	✓B15	234-411	1	Light-emitting diode (LED)	
	234-373	1	Cabinet back		✓B16	234-395	3	Insulator	
	234-374	1	Cabinet front		✓B17	234-329	5	Control shaft	
	234-489	4	#8 x 5/8" self-tapping phillips head screw		✓B18	354-5	12	Cable tie	
	234-422	1	Amber CRT	VX201	✓	490-210	1	Long 1/4" nut driver	

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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LABELS — NAMEPLATE

✓234-376	1	Off/on label
✓234-424	1	X-Ray precaution label
✓390-2554	1	Power rating label (EIA-416)
✓390-1255	1	Fuse replacement label
✓390-1855-20	1	FCC label
✓391-34	1	Blue and white label
✓391-673	1	Model nameplate

LINE CORD — CABLE — WIRE PAIR

✓234-506	1	Line cord
✓134-1319	1	Video cable assembly
✓234-378	12"	Coaxial cable
✓234-349	12"	Red/blue wire pair

NOTE: Some of the following wires may be precut to two or more shorter lengths. The total of the separate lengths should equal the length shown in the list.

SINGLE-COLOR WIRES

✓344-34	15"	Large brown wire
✓344-35	15"	Large orange wire
✓344-36	17"	Large yellow wire
✓344-210	48"	Large black wire
✓344-52	18"	Small red wire
✓344-54	12"	Small yellow wire

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
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Single-Color Wires (cont'd.)

✓344-55	18"	Small green wire
✓344-50	12"	Small black wire
✓344-51	12"	Small brown wire
✓344-53	12"	Small orange wire
✓340-8	12"	Small bare wire
✓340-9	24"	Large bare wire

STRIPED WIRES

NOTE: The main color of each wire is called out first, followed by the color of the stripe.

✓344-71	18"	White-brown wire
✓344-72	18"	White-red wire
✓344-73	18"	White-orange wire
✓344-74	18"	White-yellow wire
✓344-75	18"	White-green wire
✓344-76	18"	White-blue wire
✓344-77	18"	White-violet wire
✓344-78	18"	White-gray wire
✓234-326	30"	Red-white wire (Two 15" lengths)
✓234-325	18"	Red-black wire
✓234-327	18"	Green-yellow wire
✓234-328	18"	Green-blue wire
✓234-340	12"	Yellow-blue wire
✓234-428	12"	Yellow-orange wire

NOTE: You should have the following wires left over from the Small Circuit Boards assembly:

- ✓20-1/4" white/black



STEP-BY-STEP ASSEMBLY

CONTROL CIRCUIT BOARD WIRING

Refer to Pictorial 5-6 for the following steps.

You will be installing wires on the main circuit board in the following steps. All of the wires will be the small type unless specified otherwise. Also, all of the wires are cut to the right length at the factory, so you will not have to shorten them unless instructed otherwise. Be sure to measure each wire because you may be furnished two wires of the same color, but different lengths. When you are instructed to use a wire, remove 1/4" of insulation from both ends.

Connect only one end of the wires to the circuit board in the following steps. The other end will be connected later. Solder each wire to the foil side as you install it and cut off the excess lead lengths.

(✓) Position the control circuit board as shown.

(✓) 18" white-red to hole WHT/RED. NOTE: Do not confuse this wire with the red-wht. The red-wht is all red with a white stripe. The wht-red is just the opposite.

(✓) 18" white-brown to hole WHT/BRN.

(✓) 18" white-black to hole WHT/BLK.

(✓) 18" red to hole RED.

(✓) 18" red-white to hole RED/WHT.

(✓) 18" red-black to hole RED/BLK.

(✓) 18" green-blue to hole GRN/BLU.

(✓) 18" green to hole GRN.

(✓) 18" green-yellow to hole GRN/YEL.

(✓) 18" white-yellow to hole WHT/YEL.

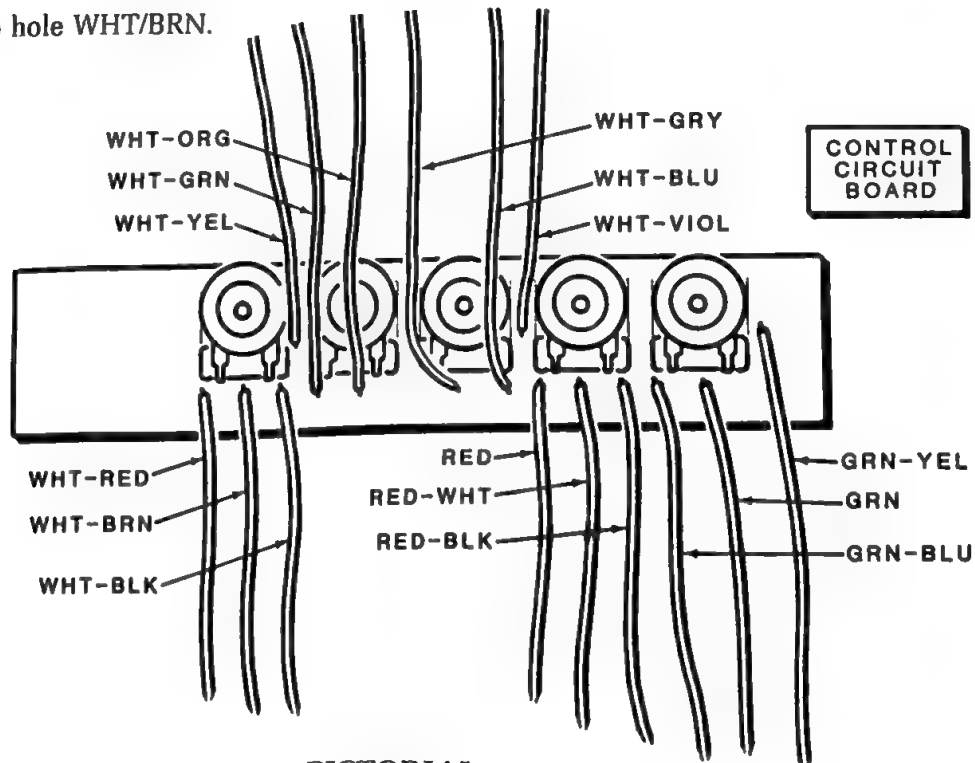
(✓) 18" white-green to hole WHT/GRN.

(✓) 18" white-orange to hole WHT/ORN.

(✓) 18" white-violet to hole WHT/VIO.

(✓) 18" white-gray to hole WHT/GRY.

(✓) 18" white-blue to hole WHT/BLU.



PICTORIAL 5-6

Refer to Pictorial 5-7 (Illustration Booklet, Page 10) for the following steps.

- (✓) Group and route the wires as shown. Then fasten each group of wires to the board with cable ties at locations C, D, and E. Clip off the excess ends of the ties.
- (✓) Position the main circuit board below the control circuit board as shown.

You will be connecting the wires from the control circuit board to the main circuit board in the following steps. Solder the wires to the foil side of the board and cut off the excess wire lengths.

- (✓) White-red to hole WHT/RED.
- (✓) White-brown to hole WHT/BRN.
- (✓) White-black to hole WHT/BLK.
- (✓) Red to hole RED.
- (✓) Red-white to hole RED/WHT.
- (✓) Red-black to hole RED/BLK.
- (✓) Green-blue to hole GRN/BLU.
- (✓) Green to hole GRN.
- () Green-yellow to hole GRN/YEL.

Refer to Pictorial 5-8 (Illustration Booklet, Page 10) for the following steps.

- (✓) Group and route the wires as shown. Then fasten each group to the board with cable ties at locations A and B. NOTE: Leave the cable tie at B slightly loose since another wire will be inserted later.

Connect the remaining wires coming from the control board to the main board in the following steps.

- (✓) White-gray to hole WHT/GRY.
- (✓) White-violet to hole WHT/VIOL.
- (✓) White-blue to hole WHT/BLU.
- (✓) White-green to hole WHT/GRN.
- (✓) White-yellow to hole WHT/YEL.
- (✓) White-orange to hole WHT/ORG.
- (✓) Group and route the wires as shown. Then fasten them to the circuit board with a cable tie at location H.

Set the control and main board aside temporarily.

Done



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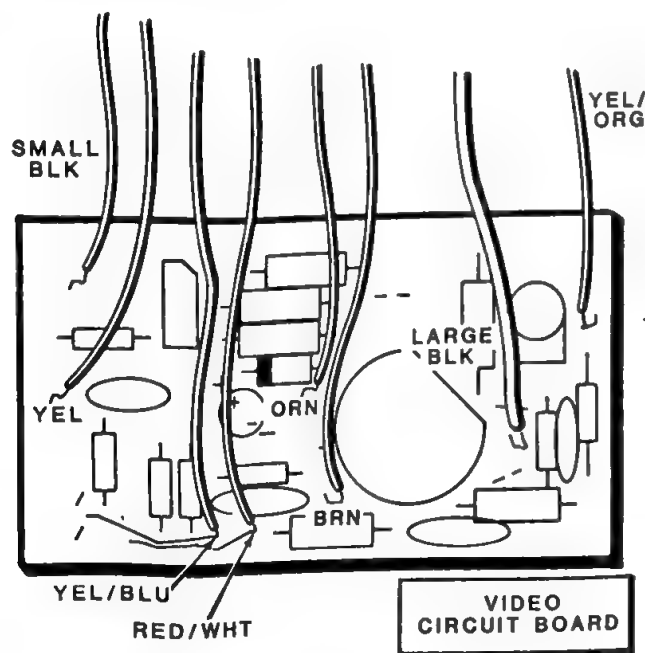
VIDEO CIRCUIT BOARD WIRING

Refer to Pictorial 5-9 for the following steps.

- (✓) Position the video circuit board as shown.

Connect one end of the following wires to the video board in the following steps. Solder the wires to the foil side and cut off the excess wire lengths.

- (✓) 12" small black to hole BLK.
- (✓) 12" yellow to hole YEL.
- (✓) 12" yellow-blue to hole YEL/BLU.
- (✓) 12" red-white to hole RED/WHT.
- (✓) 12" orange to hole ORN.
- (✓) 12" brown to hole BRN.
- (✓) 12" yellow-orange to hole YEL/ORN.
- (✓) Prepare a 16" large black wire. Connect one end to hole BLK.



PICTORIAL 5-9

Refer to Pictorial 5-10 (Illustration Booklet, Page 11) for the following steps.

- (✓) Group and route all of the wires, except the yellow wire and large black wire. Then fasten them to the video board with a cable tie at location F.
- (✓) Position the main and video circuit board as shown.

Connect the wires from the video board to the main board in the following steps. Solder the wires to the foil and cut off the excess wire lengths.

- (✓) Black to CRT BLK.
- (✓) Yellow to hole CRT YEL.
- (✓) Brown to hole BRN.
- (✓) Yellow-orange to hole CRT YEL/ORN.
- (✓) Red-wht to hole CRT RED/WHT. NOTE: The RED/WHT may be hidden under a capacitor.
- (✓) Yellow-blue to hole CRT YEL/BLU.
- (✓) Orange to hole ORN.
- (✓) Prepare a 10" large black wire. Connect one end to hole DAG. Route the other end of the wire through cable tie B. Pull the tie tight.
- (✓) Solder this wire and the large black wire coming from the video board to a #6 solder lug.

Set this assembly aside temporarily.

POWER TRANSFORMER

Parts Mounting

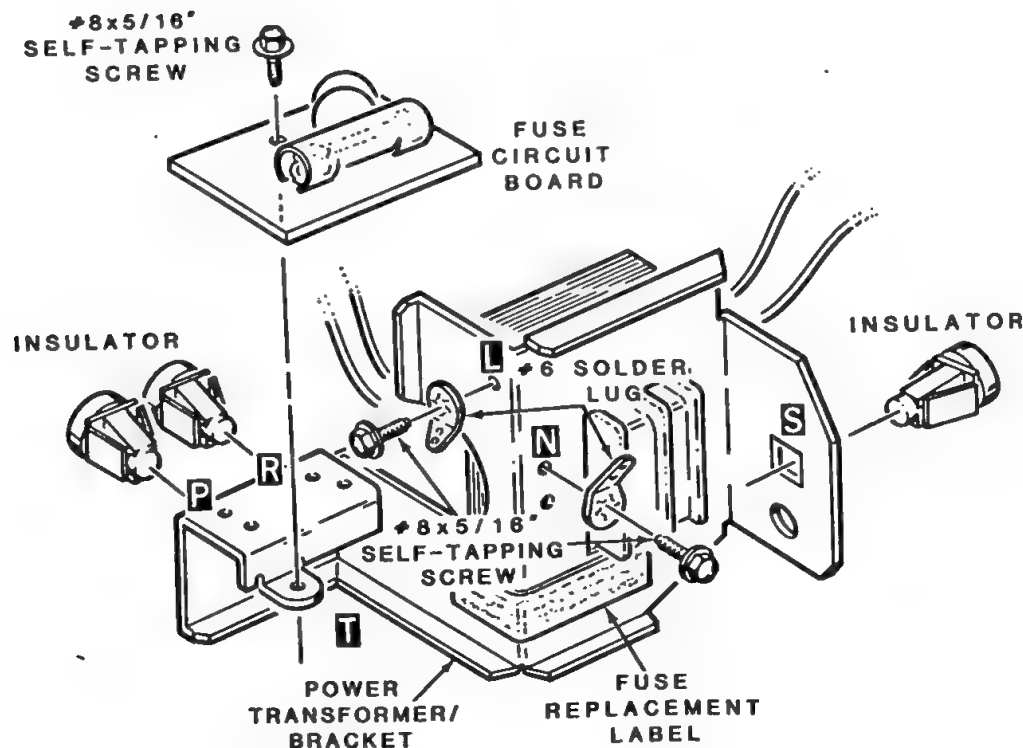
Refer to Pictorial 5-11 for the following steps.

- (✓) Position the power transformer/bracket as shown.
- (✓) Mount #6 solder lugs on the bracket at L and N with #8 × 5/16" self-tapping screws.
- (✓) Install insulators at P, R, and S by pushing them into the holes.
- (✓) Mount the fuse circuit board at T with a #8 × 5/16" self-tapping screw.
- (✓) Locate the fuse replacement label and write "3/4-ampere 3AG slow-blow" below the printing on the label.
- (✓) Peel the paper backing from the label and install the label on the bracket at the location shown.

Wiring

Refer to Part A of Pictorial 5-12 for the following steps.

- (✓) Position the power transformer/bracket as shown.
 - (✓) Locate the line cord, twist together the fine wires of each lead, and apply a small amount of solder to the ends.
- Connect the line cord and power transformer to the fuse circuit board in the following steps. Solder the leads to the foil and cut off the excess lead lengths.
- (✓) Ribbed lead of the line cord to hole 120V LINE BLK/WHT.
 - (✓) Center lead of the line cord to solder lug L (S-1).
 - (✓) Smooth lead of the line cord to hole 120V LINE BLK.
 - (✓) Fasten the line cord to the bracket with cable ties at locations J and K.



PICTORIAL 5-11

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Refer to Part B of Pictorial 5-12 for the following steps.

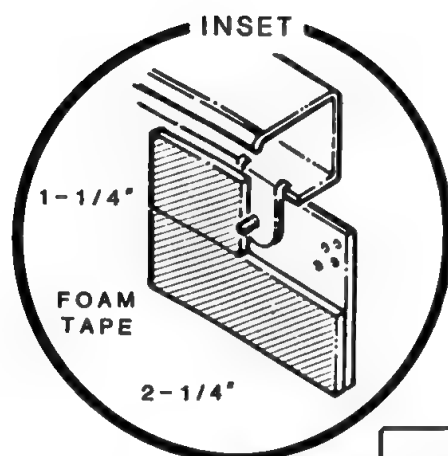
- (✓) Gray-brown transformer lead to hole XFMR 120V/220V GRA/BRN.
- (✓) Gray transformer lead to hole XFMR 120V/220V GRA.

Carefully inspect the foil side of the fuse circuit board for the following most-commonly-made errors.

- (✓) Unsoldered connections.
- (✓) Poor soldered connections.
- (✓) Solder bridges between foil patterns.
- () Protruding leads which could touch together.

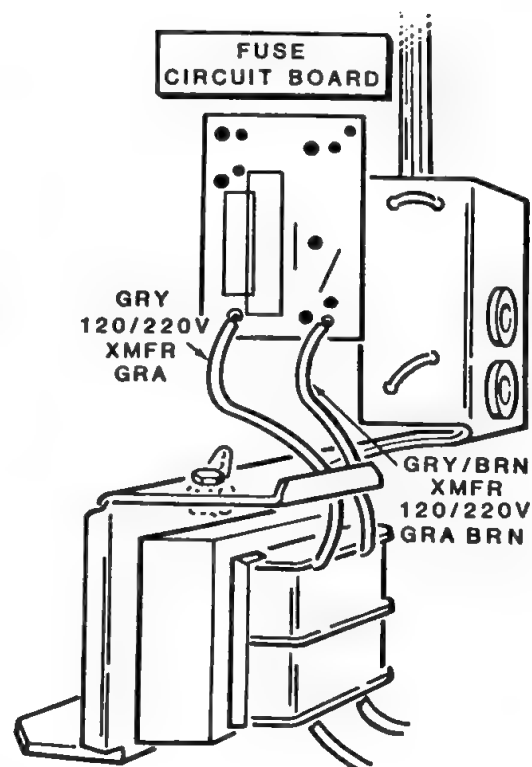
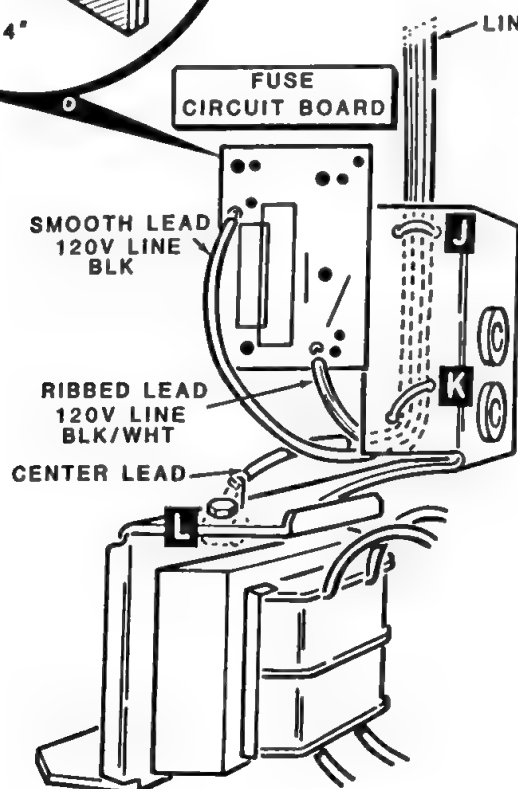
- (✓) Cut a 1-1/4" and 2-1/4" length of foam tape. Peel the paper backing from one side only of each piece of tape and install the tape on the foil side of the circuit board as shown in the inset drawing.

Set this assembly aside temporarily.



PART A

PART B



PICTORIAL 5-12



SWITCH WIRING

Refer to Pictorial 5-13 for the following steps.

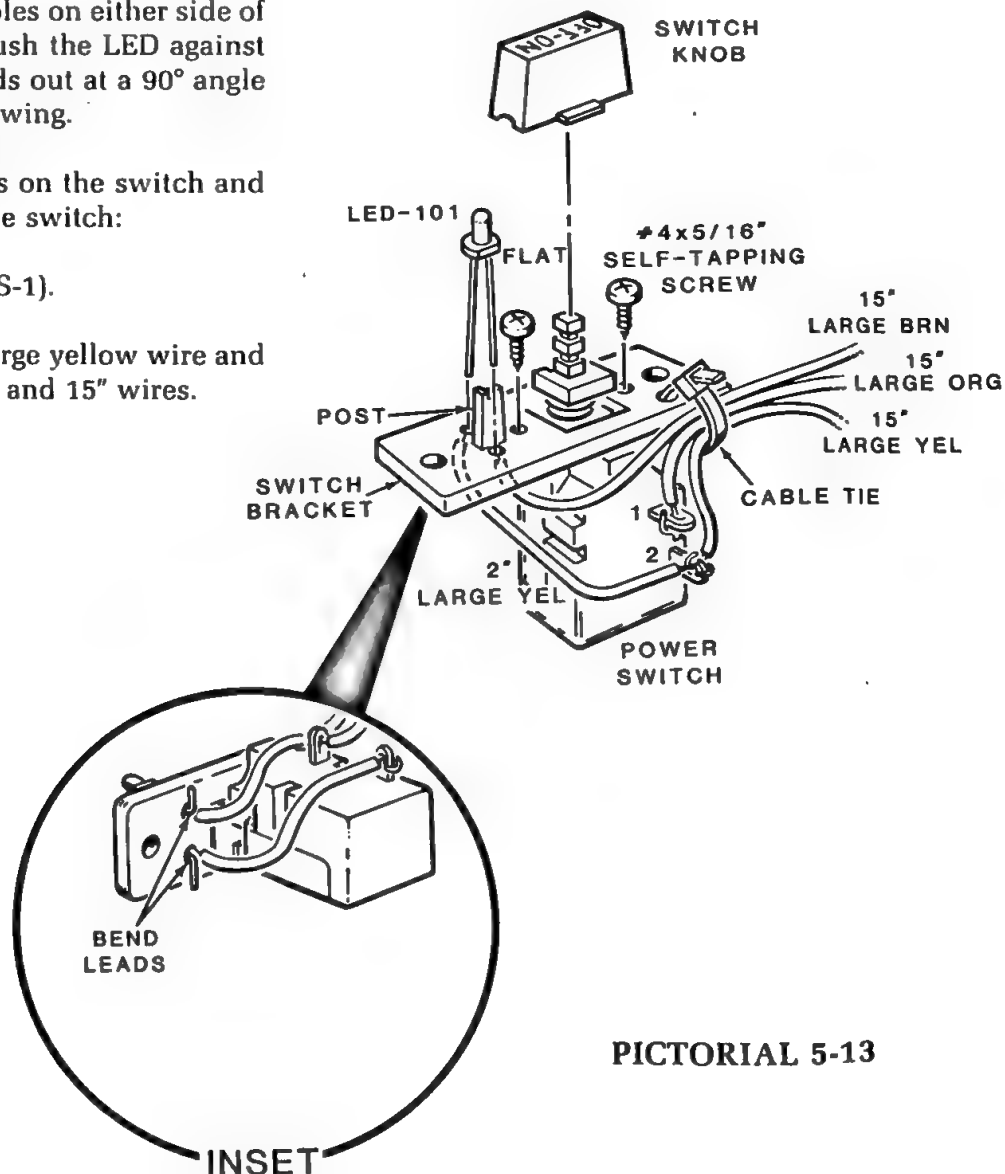
- (✓) Position the power switch and switch bracket as shown. Mount the bracket on the switch with two #4 × 5/16" self-tapping screws.
- (✓) Remove the paper backing from the OFF/ON label; then press the label into the recess of the power switch knob. Also peel the thin clear film from the front of the label.
- (✓) Position the switch knob so the words OFF/ON are as shown and push the knob on the switch shaft until it snaps into place.
- (✓) Position LED-101 with the flat as shown and insert the leads into the holes on either side of the post of the bracket. Push the LED against the post and bend the leads out at a 90° angle as shown in the insert drawing.

Disregard any letters or numbers on the switch and connect the following wire to the switch:

- (✓) 15" large orange to lug 1 (S-1).
- (✓) Cut a 2" length from the large yellow wire and prepare the ends of the 2" and 15" wires.

- (✓) 15" large yellow to lug 2 (NS).
- (✓) 2" large yellow to lug 2 (S-2). Push the other end of the lead into the indicated hole of the switch bracket and solder the wire to the LED lead.
- (✓) Similarly connect the 15" large brown wire to the other LED lead.
- (✓) Group the wires and fasten them to the switch plate with a cable tie.

Set the assembly aside temporarily.



PICTORIAL 5-13

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WIRING TO MAIN CIRCUIT BOARD

Refer to Pictorial 5-14 (Illustration Booklet, Page 12) for the following steps.

- (✓) Position the main circuit board, power switch, power transformer/bracket, and width circuit board as shown. The control and video boards should be in the positions shown.

You will be wiring the following assemblies to the main board in the following steps. Solder the wires to the foil side and cut off the excess wire lengths.

Power Switch

- (✓) Brown wire to hole BRN.
- (✓) Yellow wire to hole YEL. First route this wire through cable tie H. Then pull the tie tight.
- (✓) Orange wire to hole ORN.

Power Transformer/Bracket

- (✓) Twist the remaining two transformer leads together as shown.

Connect the transformer leads to the main circuit board in the following steps. Slide a ferrite bead (large) on the bare end of each lead as you install it.

- (✓) Red lead to RED.
- (✓) Brown lead to BROWN.
- (✓) Connect a 12" large black wire from solder lug N (S-1) on the transformer/bracket (see inset drawing #1) to the clip lug (NS) on the width circuit board.

Width Circuit Board

Refer to inset drawing #2 when you perform the next five steps.

- (✓) C1: 82 pF (820) ceramic capacitor. Cut both leads to 7/8". NOTE: The capacitor may be marked 820.

- (✓) FB1, FB2: Slip two ferrite beads (small) onto one lead of capacitor C1. Then connect this lead to J1 (S-1). Leave about 1/4" of the lead exposed between the ferrite bead and the capacitor body.

- (✓) Bend this lead sharply between the capacitor body and the ferrite bead. Then connect the other capacitor lead to the clip (NS).

- (✓) Form a hook at the shorter end of the inner lead of the coaxial cable and connect this hook to the sharp bend of the capacitor lead (S-1).

- (✓) Connect the shield lead of the coaxial cable to the clip of J1 (S-3).

- (✓) Connect the inner lead at the other end of the coaxial cable to the indicated VIDEO INP hole and the shield lead to the other hole.

- (✓) Connect the small yellow wire coming from the width board to hole YEL on the main board.

DEFLECTION YOKE WIRING

Refer to Pictorial 5-15 (Illustration Booklet, Page 13) for the following steps.

- (✓) Position the deflection yoke next to the main circuit board as shown.
- (✓) Separate both ends of the red/blue pair of wires 1" and prepare the ends.

You will be wiring the yoke to the main and width circuit boards in the following steps.

Connect the red-blue pair of wires as follows:

- (✓) Red from lug 5 (S-1) of the yoke to YOKE RED on the main board.
- (✓) Blue from lug 7 (S-1) of the yoke to YOKE BLU on the main board.



Connect the yellow-black pair of wires coming from the width circuit board as follows:

- (✓) Yellow to lug 2 (S-1) of the yoke.
- (✓) Black to lug 3 (N-S) of the yoke.
- (✓) Prepare a 10" large black wire.
- (✓) Connect one end of the wire to lug 3 (S-2) of the yoke and the other end to YOKE BLK on the main circuit board.

Refer to Pictorial 5-16 (Illustration Booklet, Page 14).

- (✓) Position the wire insulator as shown and mount it on the transistor heat sink with two #6 × 5/16" self-tapping screws.

Route the following wires through the holes in the wire insulator in the following steps.

WIDTH CIRCUIT BOARD

- () Yellow wire through hole U.

VIDEO CIRCUIT BOARD

- (✓) Yellow-blue and black wire through hole R.
- (✓) Yellow wire through hole P.
- (✓) Red/white, orange, brown, and yellow-orange wire through hole V.
- (✓) Large black wire through hole S.

DEFLECTION YOKE

- (✓) Large black wire through hole S.

TRANSFORMER

- (✓) Transformer leads through hole T.

This completes the circuit boards wiring.

CIRCUIT BOARDS CHECKOUT

Carefully inspect the foil side of each circuit board (with the exception of the fuse board) for the following most-commonly-made errors.

- (✓) Unsoldered connections. Note that the main board should have only one unsoldered foil pad hole.
- (✓) Poor solder connections.
- (✓) Solder bridges between foil patterns.
- (✓) Protruding leads which could touch together or the chassis when the circuit board is installed later.

Refer to the illustrations where parts were installed as you make the following visual checks:

- (✓) Electrolytic capacitors for the correct position of the positive (+) or negative (-) marked lead.
- (✓) Diodes for the proper type and installation (correct position of the banded end).
- (✓) Transistor for the proper installation.
- (✓) Integrated circuit for the proper installation.

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MOUNTING THE COMPONENTS

- () Clear your work surface of wire clippings, bits of solder, and other scrap materials. Then arrange your tools and the remaining parts and hardware so you have a clear area of at least two by three feet.

Refer to Pictorial 6-1 as you perform the following steps.

- (✓) Place a towel or soft cloth on your work surface to avoid scratching the cabinet or cathode ray tube (CRT). Then lay the CRT cabinet face down on the cloth.
- (✓) Remove and save the four #8 × 5/8" phillips head self-tapping screws from the indicated locations of the cabinet back. Then remove the back and set it aside.

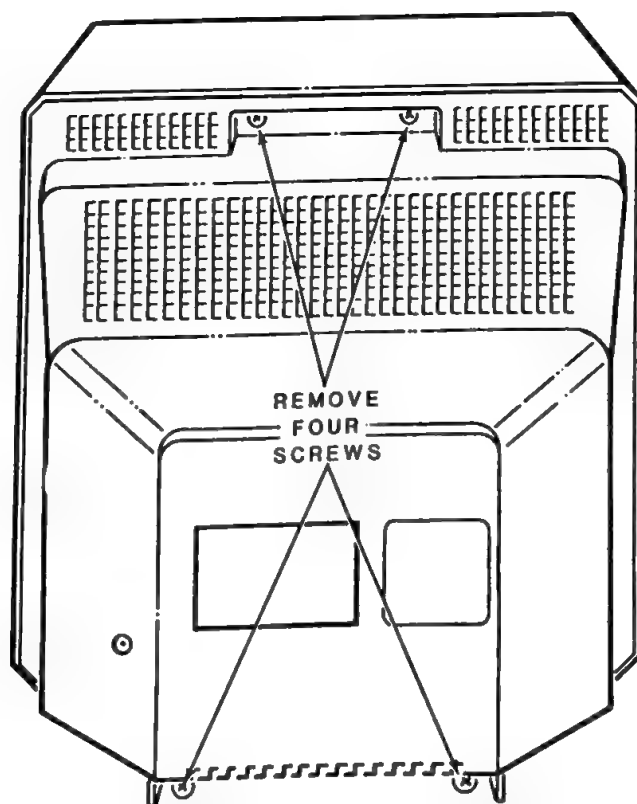
CAUTION: Be very careful when you work around the back of the CRT. Observe the following precautions:

✓ Do not bump or scratch the glass of the CRT, especially its neck.

✓ Do not apply pressure to the neck of the CRT or lift it by its neck.

Do not remove the protector from the pins of the CRT until you are told to do so.

Do not touch the second anode cavity on the side of the CRT. A charge may have built up in the CRT and you could receive an electrical shock.



PICTORIAL 6-1

*remove brown
screw*

Refer to Pictorial 6-2 (Illustration Booklet, Page 15) as you perform the following steps.

- (✓) Remove the CRT mounting screw at A, and install the longer end of the CRT spring under the washer. Then reinstall the screw and position the spring toward the neck of the CRT.
- (✓) Loosen the hex head CRT mounting screws at B and D.
- (✓) Straighten the bends and kinks from the 24" large bare wire. Then insert one end of this wire under the mounting bracket at B until about 1-1/2" of the end of the wire is exposed on the other side of the bracket. Bend this end of the wire over the bracket and wrap it around the longer end at least twice.
- (✓) Pass the free end of the bare wire through the loop in the end of the CRT spring and route the wire to the mounting bracket at D.
- (✓) Insert the end of the wire under the bracket and pull it tight enough to stretch the spring at least one inch. Then bend the end of the wire back over the bracket and wrap it around the longer portion of the wire.
- (✓) Tighten the screws at A and B. You will tighten screw D later.
- (✓) Locate the insulator (#75-109). Then refer to Inset drawing #1 and cut the insulator to 2-3/4" x 4".
- (✓) Remove the backing from the insulator and press the adhesive side onto the flat surface of the shield plate (#234-365). Make sure the insulator covers the entire plate.
- (✓) Install the insulated shield plate on the inside bottom of the cabinet as shown in Inset #2. Position the locking tab and flange of the shield as shown and bend the ears of the locking tab to hold the shield in place.

Refer to Pictorial 6-3 (Illustration Booklet, Page 16) as you perform the following steps.

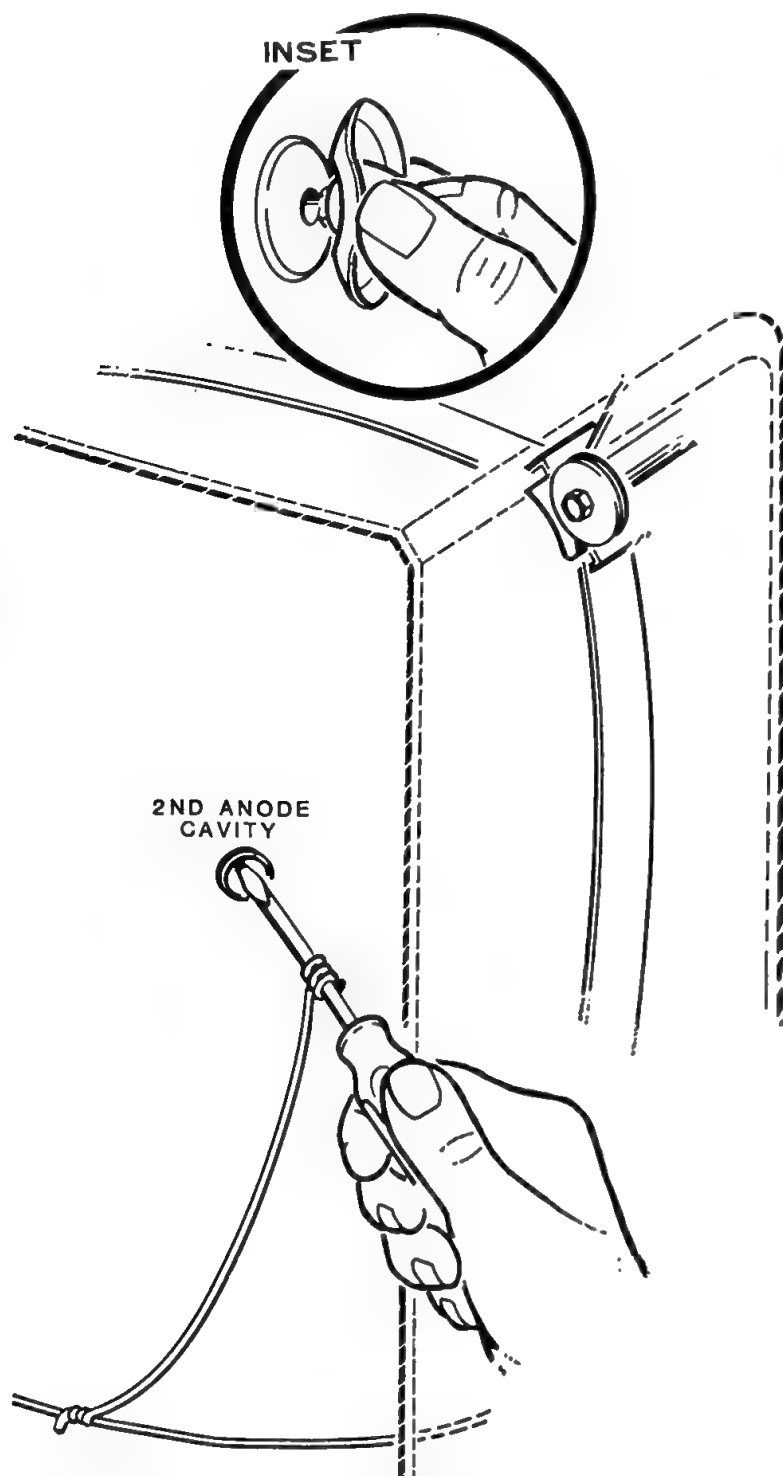
- (✓) Turn the cabinet around so the neck of the CRT faces you. Then position the assembled circuit boards, power switch assembly, yoke, and the power transformer/bracket as shown in the Pictorial.

NOTE: Two useful tools are supplied to help you install hex head screws in hard to reach holes. Use the plastic nut starter to hold and start a screw, then use the long 1/4" nut driver to tighten it.

- (✓) Install the control circuit board as shown with three #8 x 5/16" self-tapping screws.
- (✓) Be sure the LED on the power switch assembly enters the hole in the front panel; then install the assembly with two #8 x 1/2" self-tapping screws. NOTE: Make sure you do not use the #8 x 5/8" screws.
- (✓) Carefully slide the main circuit board into the grooves in the bottom of the cabinet. Be sure you do not pinch or tangle any wires.
- (✓) Slide the deflection yoke onto the neck of the CRT.
- (✓) Remove and discard the plastic protector from the pins of the CRT. Then position the video circuit board as shown in Pictorial 6-3 and carefully push the 7-pin socket onto the pins of the CRT.
- (✓) Remove the CRT mounting screw at D and install the #6 lockwasher (with two large black wires attached) under the screw. Reinstall and tighten the screw.

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- (1) Refer to Detail 6-3A and wrap the bare end of a length of wire around the CRT grounding wire and wrap the other end of the wire around the blade of a screwdriver as shown. Then carefully insert the tip of the screwdriver into the second anode cavity on the side of the CRT. This will discharge any potential that might have built up in the CRT and prevent the chance of a shock.

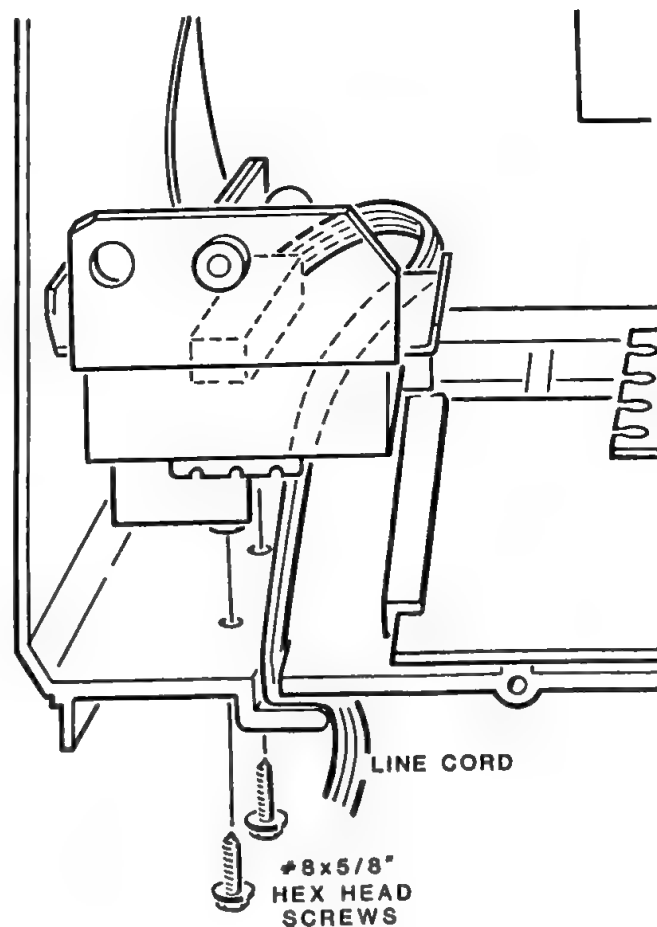


Detail 6-3A

- (2) See the inset drawing and connect the second anode lead to the cavity as shown. Squeeze the insulator back to expose the connector clips; then insert the connector into the cavity and lay the insulator against the CRT.

Refer to Pictorial 6-4 as you perform the following steps.

- (3) Position the power transformer/bracket inside the cabinet as shown. Route the line cord along the side of the bracket and into the slot in the cabinet bottom. Then secure the bracket to the cabinet with two #8 x 5/8" hex head screws.



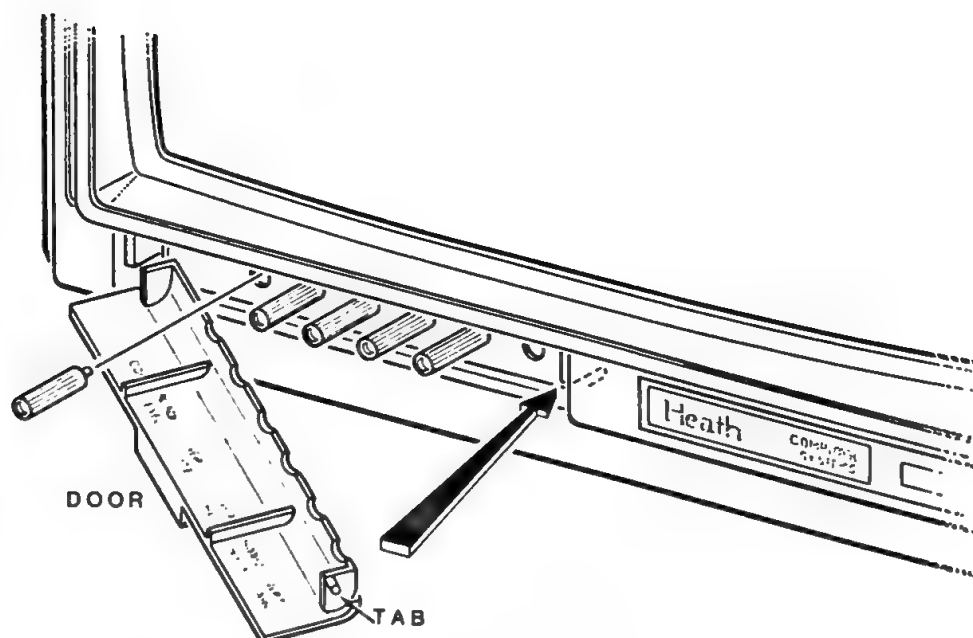
PICTORIAL 6-4

Refer to Pictorial 6-5 as you perform the following steps.

- (✓) Turn the front of the cabinet toward you and insert a control shaft into each of the five controls as shown. Insert the flats of each shaft into the slot of each control.
- (✓) Rotate each control shaft to the center of its rotation.
- (✓) Place the tab at the left side of the control door into the hole in the recessed area. Then press the tab at the right side of the door into its hole and close the door.

- (✓) Peel the backing from the nameplate and carefully position the nameplate in the recess on the lower front of the cabinet as shown. Be sure the small round hole and the rectangular hole in the nameplate lines up with the holes in the cabinet.

This completes the mounting of the components. You will install the cabinet back after you complete the following "Initial Tests and Adjustments".



PICTORIAL 6-5

INITIAL TESTS AND ADJUSTMENTS

INITIAL TESTS

PRIMARY WIRING TESTS

A wiring error in the primary wiring circuit (line cord, line fuse circuit board, etc.) of your kit could cause you to receive a severe electrical shock. These "Primary Wiring Tests" will help you eliminate any such wiring errors that may exist.

() Be sure the line cord is not plugged in.

If you do not have an ohmmeter, carefully check the line cord and line fuse circuit board wiring. Then proceed to "Other Tests."

If you have an ohmmeter, perform the following resistance measurements.

() Set the ohmmeter to the $R \times 10$ range.

NOTE: If you do not obtain the correct results in any of the following steps, recheck the wiring of the line cord and line fuse circuit board. Correct the problem before you continue to the next test.

(✓) Connect one ohmmeter lead to either of the flat prongs of the line cord plug. Connect the other ohmmeter lead to the remaining flat prong of the line cord plug. The ohmmeter should indicate approximately 30 ohms.

(✓) Connect one ohmmeter lead to the round prong of the line cord plug. Connect the other ohmmeter lead to the metal bracket to which the line fuse circuit board and power transformer are mounted. The ohmmeter should indicate zero ohms.

(✓) Measure the resistance from the round prong of the line cord plug to either flat prong. The ohmmeter should indicate infinity.

This completes the "Primary Wiring Tests." If all tests produced the correct results, proceed to "Other Tests." If any of the tests produced incorrect results, you must make the necessary corrections before you continue.

OTHER TESTS

The following tests will check the remaining portion of your Monitor for wiring errors. Be sure to correct any problems you may find before you continue to the "Adjustments."

Refer to Pictorial 7-1 (Illustration Booklet, Page 17) for the locations of the following test points and connections.

- (✓) Connect the common (negative) ohmmeter lead to the metal heat sink at QX502 on the main circuit board. Leave the common ohmmeter lead connected to this heat sink until you are directed to disconnect it.

Connect the ohmmeter probe (positive lead) to the following points:

- (✓) Yellow wire at the OFF/ON SWITCH. You should measure approximately 20 Ω .
- (✓) Emitter lead (E) of transistor Q703. You should measure approximately 15 Ω .

- (✓) Collector lead (C) of transistor QX502. You should measure at least 4000 Ω . *3.8K*
- (✓) Either end of fuse FX701. You should measure at least 4000 Ω .
- (✓) Collector (tab) of transistor Q201. You should measure at least 4000 Ω . *3.8K*
- (✓) Banded end of diode CR508. You should measure at least 4000 Ω .
- (✓) Ground strap around the CRT. You should measure near zero ohms.
- (✓) Any yoke connection. You should measure at least 3000 Ω .
- (✓) Locate the X-Ray Precaution label and remove its paper backing. Then press the label onto the inside of the cabinet as shown.

If all tests produced the correct results, proceed to "Adjustments." If you did not obtain the correct results in any of the tests, refer to the "In Case of Difficulty" section of this Manual and correct the problem before you continue.

ADJUSTMENTS

- (✓) Make sure the OFF/ON switch is in the OFF (released) position.
- (✓) Open the small door on the front of the cabinet and set all five controls to the center of their rotation.
- (✓) Use a narrow-blade screwdriver and adjust the FOCUS control on the video circuit board (see Pictorial 7-2) to the center of its rotation.

WARNING: Whenever you connect the line cord to an AC outlet, hazardous voltages are present inside the Monitor cabinet. Use extreme caution when you perform the following steps.

- () Connect the line cord to a 120-volt AC outlet.
- () Push the OFF/ON switch (on the front panel) to ON. The LED next to the switch should light, and the filament in the CRT should glow.

- () Connect the Monitor VIDEO IN jack to a signal source (computer, terminal, etc.) as described in the "Installation and Operation" section of this Manual.
- () Turn the BLACK LEVEL control (in door on front panel) clockwise until the background (raster) is visible on the CRT screen.

WARNING: Very high voltages are present on the terminals and windings of the deflection yoke and on some areas of the video circuit board. Touch only the plastic collar or centering rings of the yoke as you make the following adjustments.

- () Rotate the deflection yoke on the neck of the CRT so the raster is horizontal, then use a 3/16" nut driver to snug the clamping screw.

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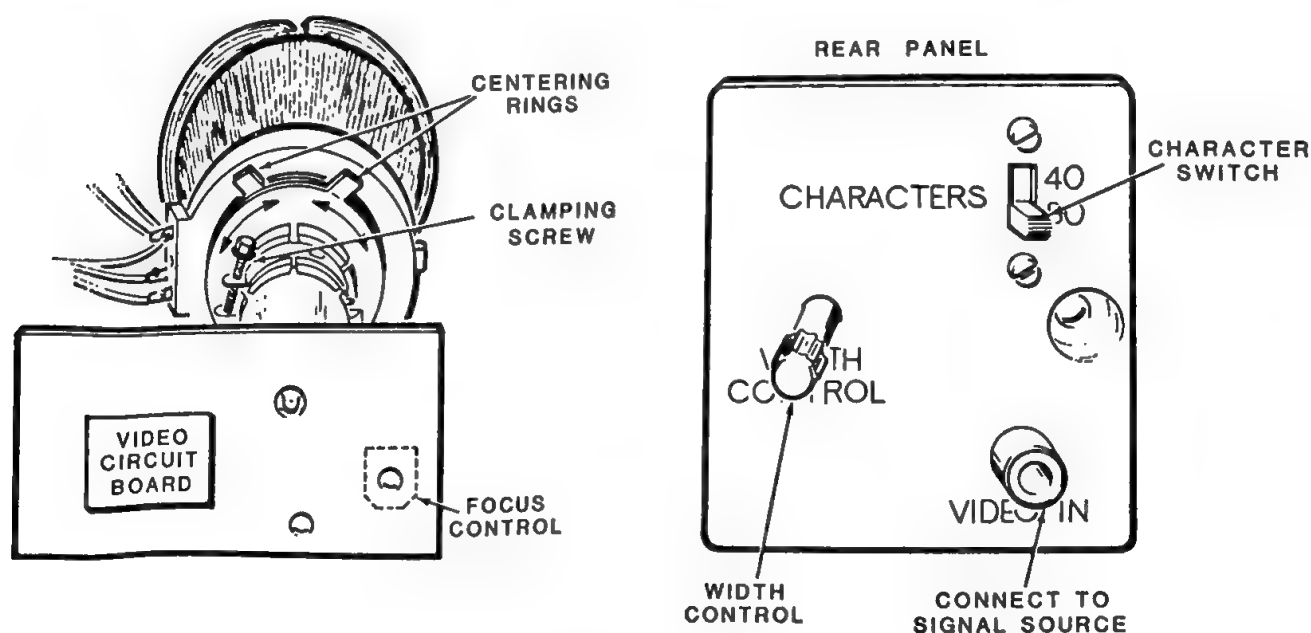
- () Adjust the VERT. SIZE control so the background (raster) nearly fills the screen at the top and bottom.
- () Adjust the WIDTH control until the screen is nearly filled horizontally.
- () Adjust the centering rings (on the back of the yoke) so the raster is equally spaced from the sides and top and bottom.
- () Repeat the VERT. SIZE and WIDTH adjustments until the raster nearly fills the screen.
- () Adjust the HORIZ. HOLD and VERT. HOLD controls for a stable display.
- () Turn THE BLACK LEVEL control counterclockwise until the raster disappears, then adjust the CONTRAST control for a pleasant brightness.
- () Use your computer or terminal to generate a screen full of characters such as the capital letter H. Set the CHARACTER switch to 40 or 80, to match the number of characters per line your program produces.

WARNING: In the following step, you will adjust the FOCUS control on the video circuit board. Be very careful not to touch foils or parts on the board with your hand or screwdriver.

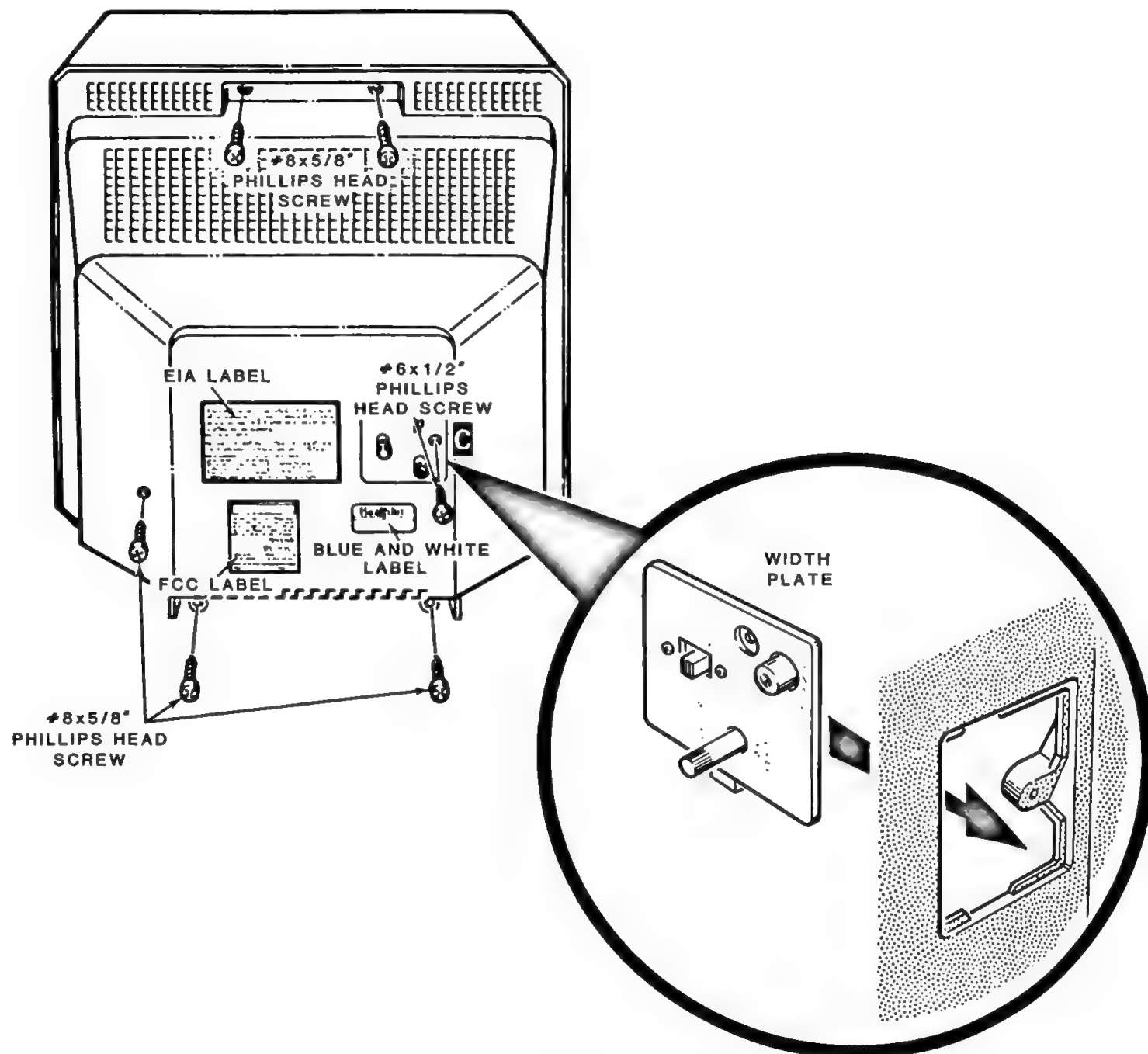
- () Insert a narrow-blade screwdriver through the hole in the circuit board and into the slot of the FOCUS control.
- () Observe a character on the screen about half way between the center and one edge. Then adjust the FOCUS control until the individual dots that make up the vertical strokes of the character are round and sharp. At the right setting, the entire character will be sharp and in focus.
- () Repeat the preceding step until no further improvement is noticed. Then remove the screwdriver from the control, and turn off your Monitor and your computer or terminal.

NOTE: You can readjust any of the controls independently to achieve the best display.

This completes the "Initial Test and Adjustments." Proceed to "Final Assembly" on the next page.



PICTORIAL 7-2



PICTORIAL 8-1

FINAL ASSEMBLY

Refer to Pictorial 8-1 as you perform the following steps.

- (✓) Position the cabinet rear panel as shown and insert the width control plate through the indicated opening from the inside. Be careful not to damage the width coil as you maneuver the plate through the opening.
- (✓) Insert the tab on the left side of the width control plate in the recessed cutout, then secure the plate with a #6 × 1/2" phillips head screw.
- (✓) Position the rear panel into the cabinet front and start a #8 × 5/8" phillips head screw into the power transformer bracket. Then reinstall the four screws that you removed from the cabinet earlier and tighten all five screws.

- (✓) Remove the paper backing from the power rating label (EIA-416) and press the label into the recess on the rear panel.

- (✓) Sign the FCC label. Then remove its paper backing and affix the label to the rear panel.

- (✓) Remove the paper backing from the blue and white label and press this label to the rear panel. Refer to the numbers on this label in any correspondence you may have with Heath Company about this kit.

This completes the assembly of your Video Monitor. Proceed to the "Installation and Operation" section that follows.

INSTALLATION AND OPERATION

INSTALLATION

Your Monitor is designed with your safety in mind. Improper use, however, can result in potential electrical shock or fire hazards. To avoid defeating the safeguards that have been built into your Monitor, please read and observe the following safety points when you install and use this Monitor:

1. Water pipes, damp earth or floors, and sinks or bathtubs containing water can all conduct electricity. Never handle any electrical appliance while you are in contact with any of these. In addition, do not use any electrical appliance in these potentially dangerous areas. Flooded basements can be especially dangerous.
2. The power cord on your Monitor contains a three prong grounded-type plug. If the prongs will not fit into your AC outlet, the outlet should be replaced by a qualified electrician.

CAUTION: To prevent electrical shock, do not use this plug with an extension cord, receptacle, or other outlet unless you can fully insert all three prongs. Do not attempt to defeat the safety purpose of this polarized plug.

3. The cabinet of your Monitor serves as a safety enclosure. Disconnect the line cord and refer to the Manual before you remove the cabinet. If the cabinet becomes broken or otherwise damaged, it could cause shock or fire hazard. Re-

place any damaged cabinet before you attempt to use the Monitor.

4. If the power cord becomes frayed or cracked, or if the plug is cracked or broken, carefully unplug the line cord; it may be a fire or shock hazard. Replace the line cord promptly.

Organize your work area and place the Monitor in a location where you can view it easily from the keyboard location. Be sure there are enough grounded outlets nearby and your source of video is convenient to the location of the Monitor. Also try to avoid glare from overhead lights.

This Monitor is made to operate on 120 volts AC, 60 Hz only. Do not attempt to operate it on any other power source.

Do not allow anything to rest on the line cord or roll over it, and do not place the Monitor in a location where the cord is subject to traffic or other abuse. Damage to the cord could result in a fire or shock hazard.

Do not place the Monitor on a sloping or unstable shelf where it might fall off. If you use a cart or stand, be sure to use one that is stable. Some roll carts can be unstable when you push them over thresholds or carpets. If you use a wall mounting, use only one that is sturdy, and follow the manufacturer's installation instructions.

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The cabinet has ventilation openings to allow heat to escape. Never cover or block the openings, as this could cause heat to build up and result in a fire hazard. Do not place the Monitor in a "built-in" enclosure that does not have open ventilating space at the bottom, back, and top. Be sure to locate the Monitor away from radiators, heaters, or other heat-producing sources. Since the Monitor is designed to be used with other equipment, also be careful not to block ventilation openings in those devices.

Caution children not to push or drop objects into the ventilation openings. These objects could cause shock or fire hazards. If you accidentally drop something inside the Monitor, first disconnect the line cord. Then remove the object. If you spill water or other liquids inside the Monitor, unplug the line cord and have it checked by a technician.

Electronic products should never be exposed to rain or water. Water and other liquids can cause electrical shorts. If your Monitor becomes damp or wet, immediately unplug the line cord. It is a good rule to never use AC-operated electronic products outdoors.

If you leave the room or building, turn the Monitor off. For added protection of the Monitor when you will not be using it for an extended period of time, unplug the line cord from the AC outlet. Note that the OFF/ON switch is in the transformer secondary circuit. The primary wiring is not switched.

The Monitor is designed for use with external equipment and contains built-in jacks or connectors as described in the "Operation" section of this Manual. Do not attach accessories to the Monitor that do not have the proper provision.

To clean the cabinet of the Monitor, use a cloth that has been very slightly dampened with a mild soap and water solution. Be careful not to allow moisture to enter the cabinet. Always unplug the line cord before you clean the display screen. Use a cloth dampened with a solution consisting of one part home laundry fabric softener and three parts water to clean the glass. You can also use most dishwashing detergents for this purpose. Be sure to wring out the cloth. Do not wipe the screen dry. Instead, allow the screen to thoroughly air dry before you turn the Monitor on. Do not apply liquid or aerosol cleaners directly to the screen.

Do not strike or scratch the glass face of the CRT screen. This may cause the tube to crack, which could cause an implosion.

CONNECTIONS

Refer to Pictorial 9-1 (Illustration Booklet, Page 18) for the location of the Video In jack on the rear of the Monitor.

This Monitor is designed for use with microcomputers that produce a NTSC composite video signal. To connect a microcomputer to the Monitor, simply connect the microcomputer and the Video In jack on the rear of the cabinet. A suitable cable is supplied with the Monitor for this purpose.

The only other connection you need to make is to connect the line cord to the proper AC outlet as described earlier in this section.

Refer to the "Operation" section of this Manual, which follows, for information concerning setup and operating the controls.

OPERATION

Refer to Pictorials 9-1 and 9-2 (Illustration Booklet, Page 18) for the locations of the controls and switches referred to in the following paragraphs.

Perform the following steps to get your Monitor ready for use:

1. Set the CHARACTER switch on the rear of the cabinet to either 40 or 80 characters per line to match your computer or terminal.
2. Push the OFF/ON switch to the on position (also turn on your computer or terminal).

OPERATOR ADJUSTMENTS

NOTE: The following information shows you how to adjust the various controls located on the front and rear of your Monitor. Normally, you would not need to readjust these controls on a day-to-day basis.

Width

Use this control to make adjustments in the overall display width.

NOTE: The following controls are located behind a small door on the front of the Monitor.

Contrast

Use this control for a pleasing, but not too bright display.

Black Level

Use this control to adjust the background lighting of the display. First turn the control clockwise until the background lights. Then turn the control counter-clockwise until the background lighting just disappears.

Vertical Size

Use this control to adjust the overall height of the display.

Vertical Hold

Use this control to stop the display from "rolling" up or down.

Horizontal Hold

Use this control to correct for a streaked or torn display.

CAUTION: Do not leave a bright, unchanging display on the screen for an extended period of time. This could burn the phosphor inside the screen and reduce the useful life of the CRT. To help prevent this from happening, either turn the Monitor off when it is not in use, reduce the brightness of the display, or use a display that is constantly changing.

IN CASE OF DIFFICULTY

Begin your search for any trouble that occurs after assembly by carefully following the steps listed below under "Visual Tests." After you complete the "Visual Tests," refer to the "Troubleshooting Charts." The left column of the chart shows some

problems that could occur. The right column shows which components could be at fault. Refer to the "Circuit Board X-Ray Views" (Illustration Booklet, Page 19) for the physical locations of parts on the circuit boards.

VISUAL TESTS

1. Recheck the wiring. Trace each lead with a colored pencil on the Pictorial as you check it. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something that you have consistently overlooked.
2. About 90% of the kits that are returned to the Heath Company for repair do not function properly due to poor connections and soldering. Therefore, you can eliminate many troubles by reheating all of your connections to make sure they are soldered as described on Page 14 of this Manual. Be sure there are no solder "bridges" between circuit board foils.
3. Check to be sure all transistors and diodes are in their proper locations. Make sure each lead is connected to the proper point. Also make sure each diode band is positioned above the band printed on the circuit board or as directed in its step.
4. Check electrolytic and tantalum capacitors to be sure their positive (+) or negative (−) mark is at the correct location.
5. Check to be sure that each IC is properly installed, and that the pins are not bent out or under the IC. Also be sure the ICs are installed in their correct locations.

6. Check the values of the parts. Be sure in each step that you wired the correct part into the circuit, as shown in the Pictorial. It would be easy, for example, to install a 22 k Ω (red-red-orange) resistor where a 2200 Ω (red-red-red) resistor should have been installed.
7. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring.
8. Check to see that no bare wires or component leads touch the surrounding ground foils on the component side of the main board.
9. Look between each circuit board and the chassis to be sure all leads were cut off short.
10. A review of the "Circuit Description" may also help determine where the trouble is.

If you have still not located the trouble after you complete the "Visual Tests," and a voltmeter is available, check voltage readings against those shown on the Schematic Diagram. Read "Precautions for Troubleshooting" before you make any measurements. NOTE: All voltage readings were taken with a high input impedance voltmeter. DC voltages and resistances may vary as much as $\pm 20\%$.

PRECAUTIONS FOR TROUBLESHOOTING

Be sure you do not short any terminals to ground when you make voltage measurements. If the probe should slip, for example, and short across components or voltage sources, it is likely to cause damage to one or more transistors or diodes.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of this Manual. Your Warranty is located inside the front cover.

AC line voltage is present at many locations in the primary wiring circuit of this Monitor, such as the fuseholder, whenever the line cord is connected to an AC outlet. Avoid any contact with this area, or unplug the line cord, whenever you have the cabinet removed from your Monitor. NOTE: The Power switch is in the secondary circuit; it does not remove power from the primary wiring circuit.

The second anode circuit (high voltage supply) does not contain a bleeder resistor. Always consider the second anode to have the full 13,000-volt potential present. Use the following procedure if you must service this area of the Monitor:

1. Unplug the line cord before you remove the cabinet rear panel.
2. Wrap one end of a bare wire around the blade of a long insulated handle screwdriver and connect the other end to the grounded bare wire that passes around the back of the CRT.
3. Hold the screwdriver by its insulated handle and slip the tip of the screwdriver under the second anode boot to discharge the CRT. NOTE: The second anode may recharge itself again even though you have not reapplied power to the Monitor. Always use extreme caution when you are working on this area of your Monitor.
4. To measure the voltage at the second anode, use only a suitable high-voltage probe and follow the probe manufacturer's instructions.

CAUTION: Should you ever have to replace a component that is identified with an "X" (CX208 for example), be sure to use an exact replacement part. Failure to do so may result in faulty operation or a potential shock hazard.

TROUBLESHOOTING CHART

The following charts list the condition and possible causes of several malfunctions. If a particular part is mentioned as a possible cause, check that part to see if it is correctly installed. Also check the parts connected to it for poor connections. It is also possible, on rare occasions, for a part to be faulty and require replacement.

CONDITION	POSSIBLE CAUSE
Monitor appears completely inoperable (power LED is not lit).	<ol style="list-style-type: none"> 1. Fuse FX201 or FX701. 2. Line cord connections (disconnect line cord before removing cabinet). 3. Transformer TX201. 4. Switch SX201 or its wiring. 5. Bridge rectifier diode CR701, CR702, CR703, or CR704. 6. Transistor Q701, Q702, or Q703. 7. LED or its installation.
Hum bars (wavy lines) present in the display.	<ol style="list-style-type: none"> 1. Capacitor CX707. 2. Interchanged resistors at R706 and R707. 3. Bridge rectifier diode CR701, CR702, CR703, or CR704. 4. Diode CR706.
No raster (background light on screen). High voltage is present.	<ol style="list-style-type: none"> 1. Misadjusted Black Level or Contrast control. 2. CRT or its socket. 3. Transistor Q201 or Q807. 4. Resistor RX711.
No high voltage.	<ol style="list-style-type: none"> 1. Transistor Q501 or Q502. 2. Horizontal yoke winding. 3. Transformer TX502. 4. Diode CR502, CR503, CR507, or CR508. 5. Integrated circuit IC501.
No horizontal sync.	<ol style="list-style-type: none"> 1. Resistor R503 or capacitor C502. 2. Misadjusted horizontal hold control. 3. Resistor R514 or R516. 4. Capacitor C506.
No vertical sync.	<ol style="list-style-type: none"> 1. Capacitor C601, resistor R602, or R603. 2. Misadjusted vertical hold control. 3. Improper video signal source. (Incorrect amplitude ratio of sync pulse to signal.)
No vertical deflection.	<ol style="list-style-type: none"> 1. Transistor Q601, Q602, Q603, Q604, or Q606. 2. Yoke TX202A.

Troubleshooting Chart (cont'd.)

CONDITION	POSSIBLE CAUSE
Only the top or the bottom of the vertical deflection is present.	1. Transistor Q604, Q606, diode CR602, or CR603.
Horizontal scans right to left, instead of from left to right.	1. Black and yellow yoke wires are interchanged.
Vertical scans from bottom to top, instead of from top to bottom.	1. Red and blue yoke wires are interchanged.
No horizontal or vertical sync.	1. Transistor Q801 or Q802.
No characters present on the screen (high and low voltage supplies are okay).	1. Capacitor C810. 2. Transistor Q805 or Q806. 3. Wiring error between circuit boards.
Poor focus.	1. Misadjusted focus control, R215. 2. High voltage is low.
Display tilted.	1. Rotate yoke TX202.
Display not centered.	1. Adjust centering rings.
High voltage is low.	1. Incorrect drive from transistor QX502. 2. Diode CR502, CR503, CR507, or CR508. 3. IC 501.

SPECIFICATIONS

Power Requirements	120 volts, 60 Hz AC only (28 watts).
Line Protection	3/4 ampere, 3AG, slow-blow fuse.
Input Signal	NTSC standard, 1 V P-P nominal.
Band Width	18 MHz.
Rise Time	50 nanoseconds.
Screen	12" diagonal.
Phosphor	Amber. (LA).
Dimensions (overall)	12-7/8" W × 11-1/2" D × 11-3/4" H. (32.7 × 29.2 × 29.8 cm).
Weight	12 lbs (5.4 kg).

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

CIRCUIT DESCRIPTION

This section will first present a general discussion of the circuits in block diagram form and trace the signal flow through the various stages of the Monitor.

Then, it will describe each of the circuits separately in greater detail and relate them to the Schematic Diagram.

GENERAL

Refer to the Block Diagram (Illustration Booklet Page 18) as you read the following discussion.

tion of the sweep signal to control the video output stage and cut off the CRT during the retrace cycle.

VIDEO AMPLIFIER AND SYNC SEPARATOR

A composite video signal contains the video information as well as the synchronization pulses that control the vertical and horizontal sweep circuits of the Monitor. This composite video signal, applied to the input jack, is amplified by a preamplifier and a driver stage and then coupled to the video output and sync separator stages. The video output stage drives the CRT with the video signal, while the sync separator stage removes the video signal and couples the synchronization pulses to the horizontal and vertical sweep circuits.

HORIZONTAL SWEEP

Horizontal synchronization pulses from the sync separator are coupled to the horizontal processor which contains a phase detector, an oscillator, a regulator, and a predriver. The output of the processor is amplified by the horizontal driver and coupled to the output stage. This horizontal output stage drives the horizontal deflection coil of the yoke, provides a control voltage to the beam current limiter, and produces higher DC voltages for the focus and video circuits, as well as the second anode accelerating voltage for the CRT.

VERTICAL SWEEP

Synchronized with the vertical sync signal from the separator, the vertical oscillator generates a vertical sweep signal that is amplified by vertical amplifier and output stages to drive the vertical deflection coil of the yoke. The vertical blanking stage uses a por-

POWER SUPPLY

When connected to a 120 volt AC power line, the power supply circuits rectify, filter, and regulate to provide a constant 12.7-volt DC supply for most of the circuits in the Monitor and 11.5 volts for the CRT filament.

DETAILED DESCRIPTION

All circuits and components of the Monitor are shown on the Schematic Diagram that is supplied as a fold-in with this Manual while the Partial Schematics that are included with the text show the circuits that are being discussed.

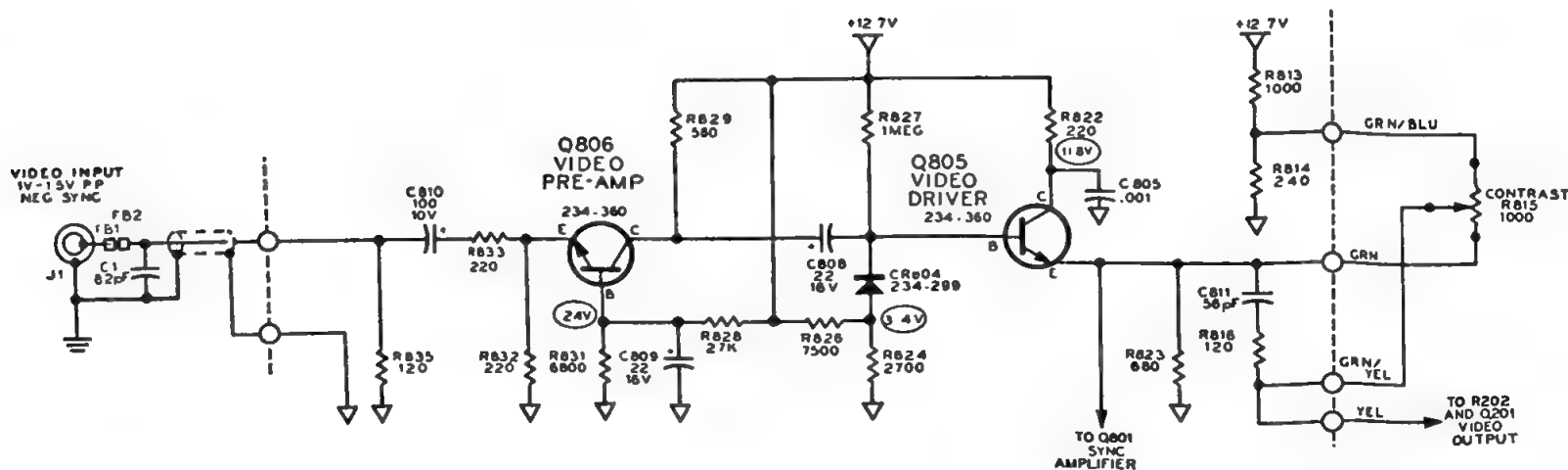
VIDEO AMPLIFIER CIRCUITS

A video preamplifier, video driver, and video output make up the video amplifier circuits. These three stages accept the video input signal, amplify it, and drive the cathode of the cathode ray tube (CRT) in the following manner.

The video input is designed to accept NTSC standard RS-170 composite video with a 75-ohm terminating input. The video signal is coupled through capacitor C810 and resistor R833 to the emitter of

video preamp transistor Q806. This is a common-base amplifier which raises the one-volt peak-to-peak signal to three volts without phase inversion. Its output is coupled through C808 to the base of video driver transistor Q805. In the base circuit of Q805 is a sync tip clamp, consisting of CR804, R824, R826, and R827, which clamps the video signal to prevent black level shifts with variations in the input signal levels.

From the emitter of the video driver, the video signal is direct-coupled through the contrast control (R815) to the base of video output transistor Q201 which drives the cathode of the CRT. Connected to the emitter of Q201 is the vertical blanking signal from transistor Q607 which blanks the CRT during the retrace cycle, and the emitter of beam current limiter Q807.

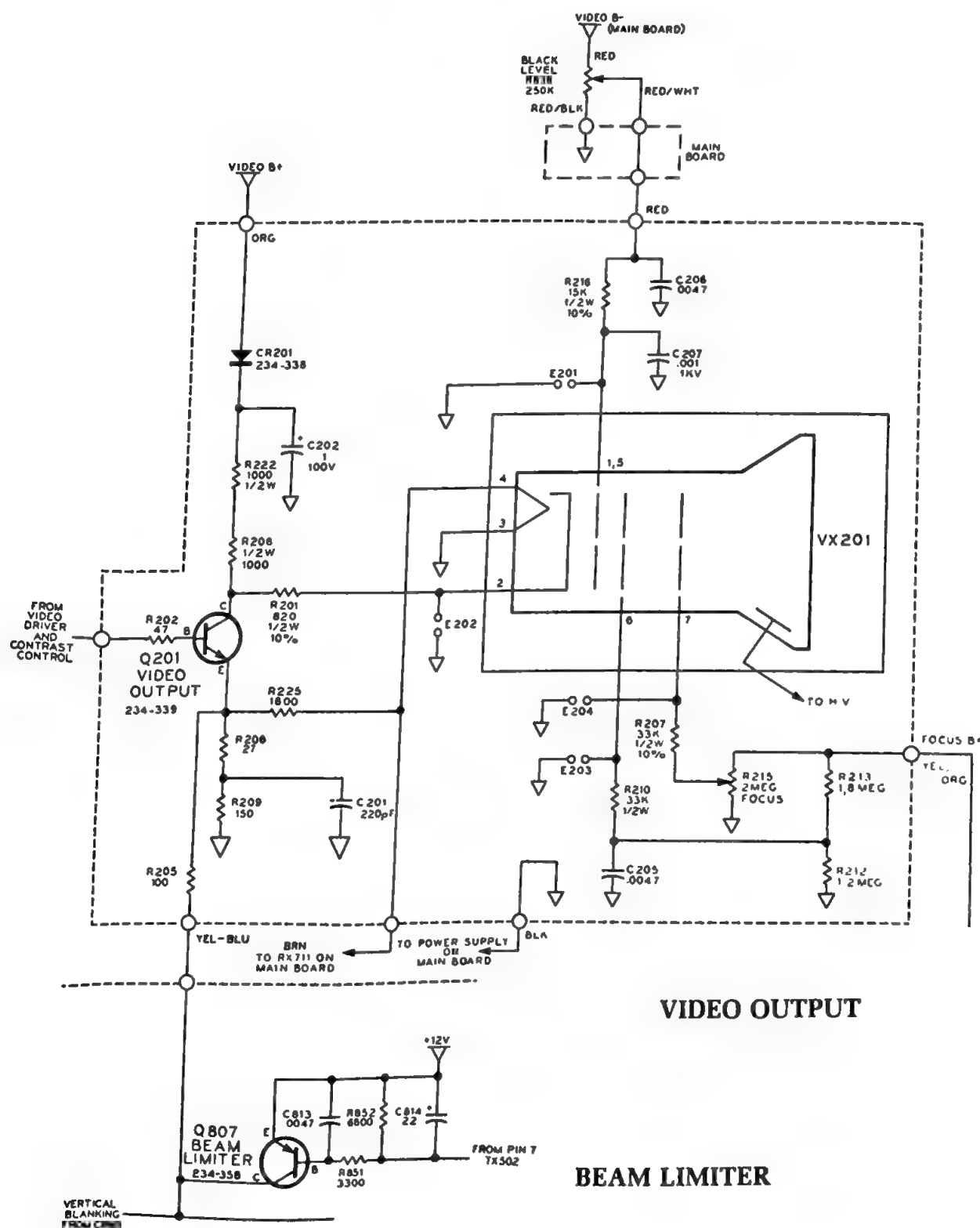


VIDEO AMPLIFIER

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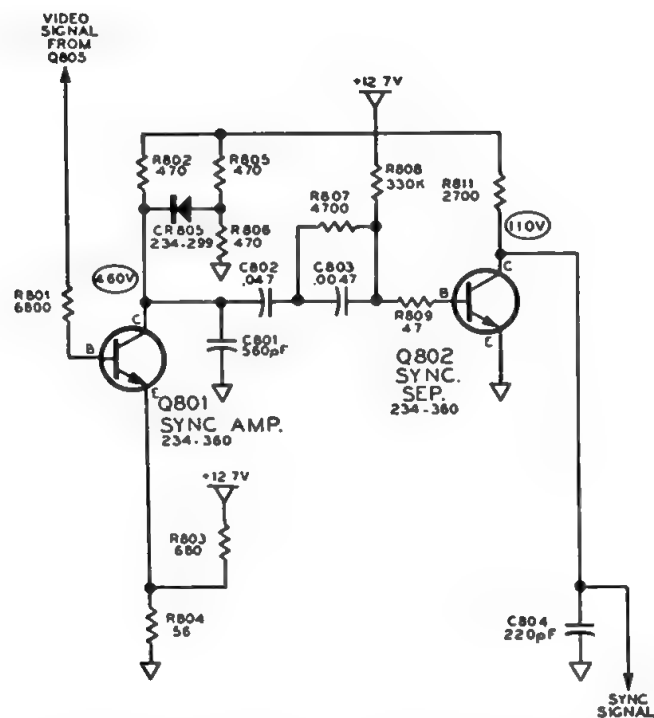
As its name implies, beam current limiter Q807 limits the amount of beam current to the cathode of the CRT. It senses the second anode current of the CRT from a tertiary winding of the horizontal output transformer. As the anode current increases, so does the collector current of Q807, which causes an increase in collector voltage on Q201. This increase causes the cathode voltage of the CRT to increase and reduce or restore the beam current.

Diode CR201 and Capacitor C202 are in the collector circuit of video output transistor Q201 to provide spot burn protection. Connected to the video B+ source, CR201 conducts while the Monitor is on, charging C202. When the Monitor is turned off, C202 sustains the Q201 collector voltage to keep the CRT cathode biased off until after its anode voltage has dropped. This keeps the beam spot from burning the phosphor of the CRT.



SYNC AMPLIFIER AND SEPARATOR

Composite video signals from video driver Q805 are also coupled (through R801) to the base of sync amplifier Q801. This circuit is used to amplify the synchronization portion before it is separated from the video signal. Transistor Q802 is a standard dual-time-constant sync separator that provides synchronization pulses for the vertical and horizontal sweep circuits.



SYNC AMPLIFIER AND SEPARATOR

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VERTICAL SWEEP CIRCUITS

The vertical sweep circuit is a self-oscillating, DC-coupled ramp-generator that uses an oscillator, complimentary push-pull class B output transistors, and a differential amplifier.

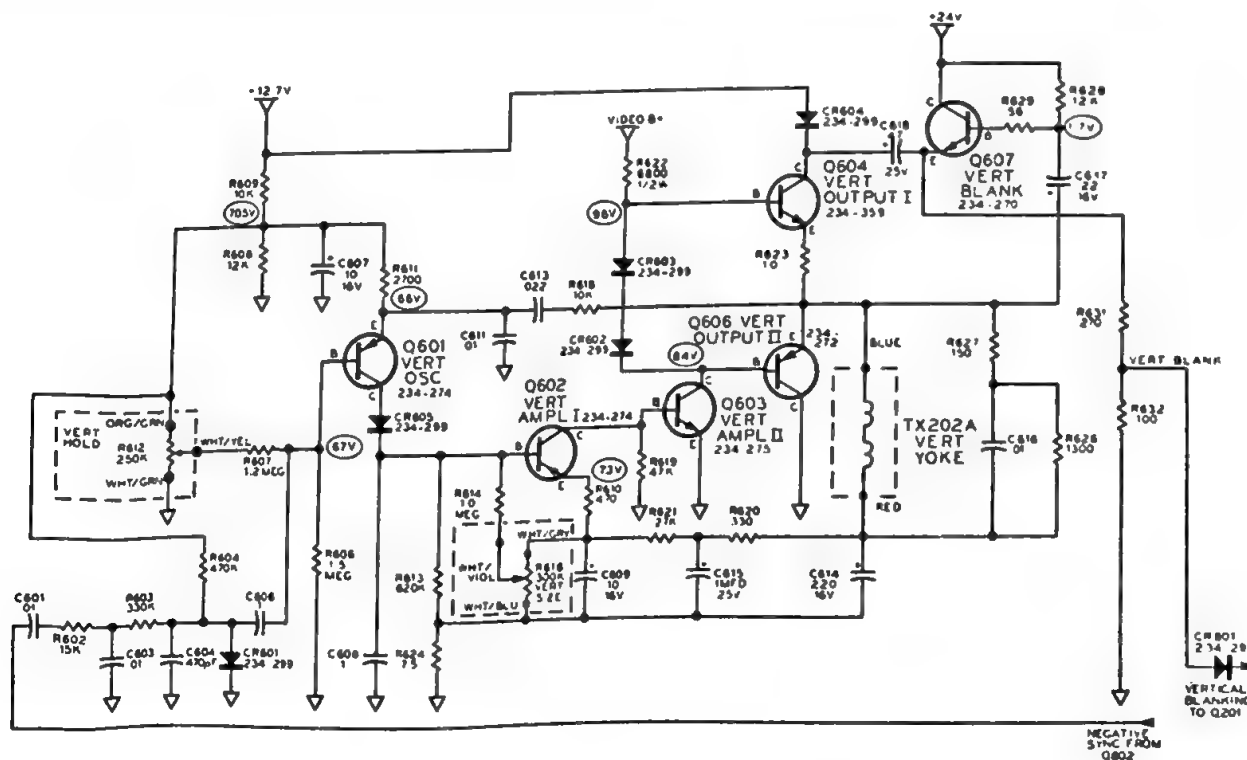
A differentiated positive-going flyback pulse passes from the emitters of the output stage, (Q604 and Q606) through R618, C613, and Q601, and causes C608 and C606 to charge. These capacitors discharge through their respective resistor networks. As C606 discharges during the trace interval to a point where the base voltage is 0.6 volts below its emitter voltage, Q601 conducts and turns off the amplifier stages. This causes the yoke voltage to fly up and repeat the cycle. A sync pulse from the sync separator, through C606, causes Q601 to conduct slightly before the base voltage decreases to 0.6 volts below its emitter voltage.

Vertical hold control R612 adjusts the charge-discharge time for C606, and synchronizes the oscillator with the composite video input signal. Normally, a stable picture is produced when the vertical hold control has been adjusted so that the free-running vertical oscillator frequency is slightly slower than

the sync frequency. The sync pulse can then cause the vertical oscillator to retrigger "on time" but just before its natural, free-running time.

Linear discharge of C608, through its resistor network, is aided by yoke current sensing resistor R624. A constant voltage appears across the sensing resistor and maintains a constant discharge current from C608. This produces a linear, negative-going ramp voltage of average DC value to the base of Q602, established by R608 and R609. The signal to the emitter of Q602 comes from the yoke return circuit.

S-correction for the ramp voltage waveform across R624 is provided for the production of a linear raster on the CRT. This is accomplished by applying an inverse S-correction signal across C609, derived through the shaping network of R620, R621, and C615. Adding this inverse S-correction signal, to the ramp's positive s-correction signal across R624, produces a linear ramp at the emitter of Q602. The linear ramp across C608 is compared by Q602, and any difference results in a correcting current in the collector of Q602 and in succeeding amplifier stages. This maintains the desired yoke current to produce a linear vertical sweep.



VERTICAL SWEEP

HORIZONTAL SWEEP CIRCUITS

Generation and synchronization of a sweep frequency signal takes place in a horizontal processor (U501). This signal is then amplified to drive the horizontal output stage for horizontal sweep of the CRT beam and to produce higher voltages needed for the second anode of the CRT and for the focus and video circuits.

Horizontal Processor

Contained in the horizontal processor integrated circuit (IC) is an oscillator, a phase detector, a regulator, and a predriver.

The phase detector consists of a differential amplifier and a gated current source, strobed by a negative-going horizontal sync signal that is applied to pin 3. A sawtooth waveform (negative-going horizontal flyback pulse) is applied to pin 4. The phase relationship between the two waveforms is compared by the differential amplifier. When the sync and sawtooth waveforms are in phase, no current will flow into or out of pin 5. However, when there is a phase difference, current will flow through the low pass filter to pin 7, which is the oscillator control.

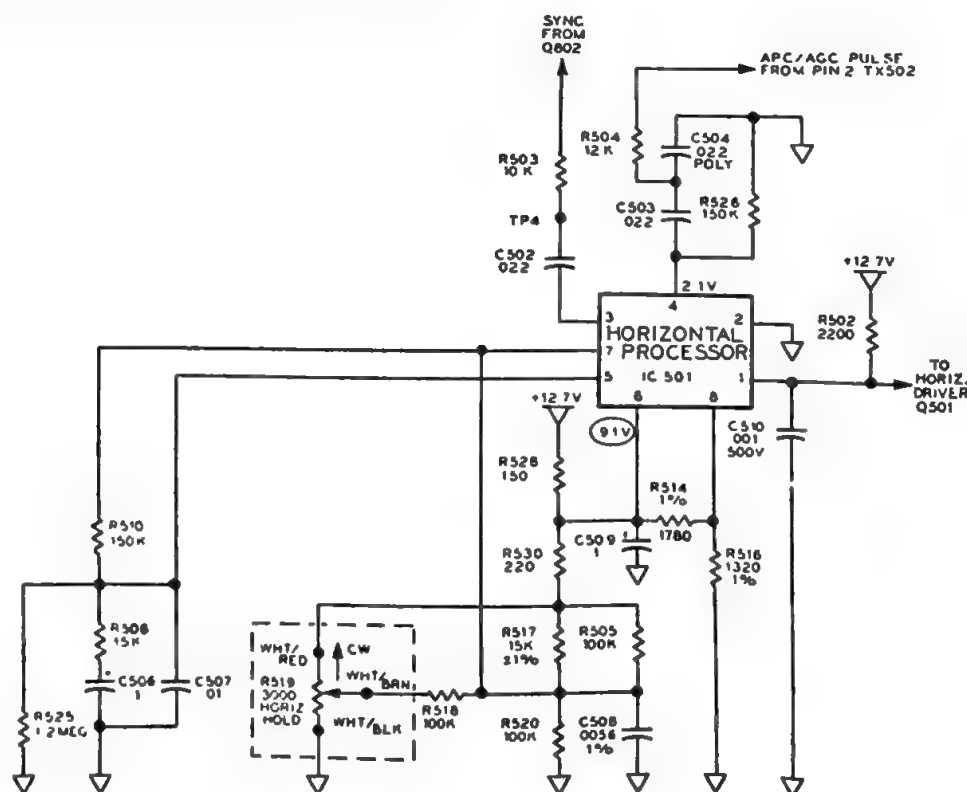
In the oscillator control circuit is a resistor-capacitor (RC) network that controls the frequency of the oscillator. Horizontal Hold control R519 and resistors

R517, R518, R520, R530, and R505 determine the charging rate of timing capacitor C508. When the charge on C508 reaches the oscillator's trip voltage, the capacitor is discharged and the cycle repeats to produce a sawtooth waveform. Resistive coupling from pin 5 to pin 7 couples the phase detector output to the oscillator. With the Horizontal Hold control set at near mid-range, the horizontal sweep can be synchronized with the sync signal.

The regulator in the horizontal processor IC (pin 6) consists of two high-current diodes in series with a zener diode. Resistor R528, connected from pin 6 to the +12.7-volt supply, sets the zener current to provide a regulated DC voltage of about 9 volts for stable operation of the processor.

A predriver in the processor IC takes the sawtooth formed at pin 7 and produces a variable duty cycle waveform output at pin 1 which drives the horizontal driver stage. Bias voltage for the predriver, set by divider resistors R514 and R516, determines the timing of the output waveform.

The number of horizontal lines of resolution depends upon the video signal applied to the input of the monitor. A video signal with a horizontal sync pulse frequency of 15,600 Hz will produce 240 lines of resolution, while a sync pulse frequency of 18,600 Hz will produce 300 lines of resolution.



HORIZONTAL SWEEP

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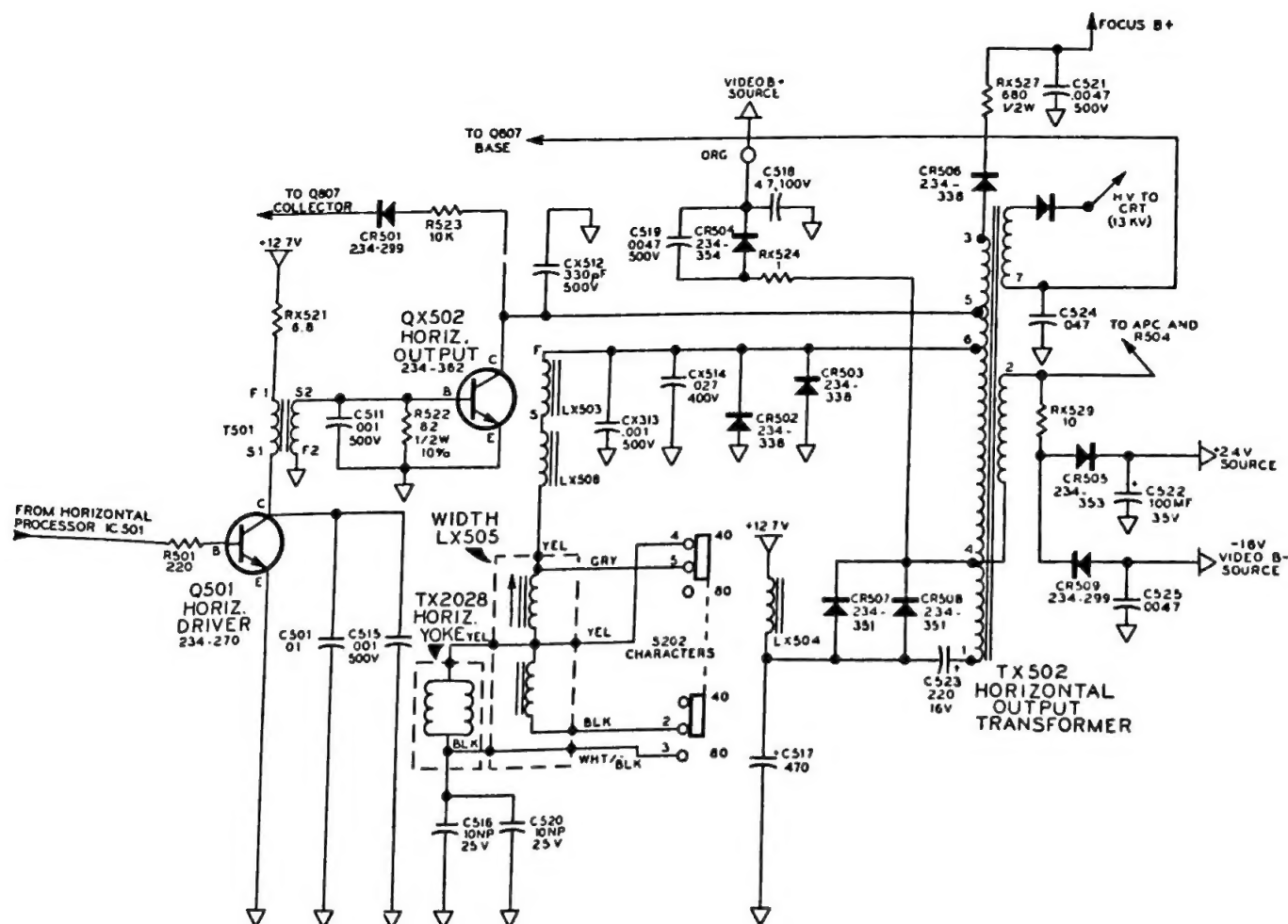
Horizontal Driver and Output

The horizontal sweep waveform from pin 1 of the processor is amplified by horizontal driver transistor Q501, and transformer-coupled to output transistor Q502 which drives the horizontal output transformer.

A tap on the primary winding of the output transformer supplies a high B+ voltage (through diode CR506 and resistor RX527) for the focus anode of the CRT, and another tap drives horizontal deflection coils of the yoke. In this horizontal deflection circuit are the width coils and a 40/80 character selector switch, used for adjusting the width of the raster to fill the screen.

Diodes CR507 and CR508 are connected to another tap on the transformer to provide a video B+ voltage source for use in other circuits. This voltage is further rectified and filtered by CR504 and C518. One end of a secondary winding is connected to the same tap on the primary. The other end of this winding supplies automatic phase control (APC) and automatic gain control (AGC) to pin 4 of the horizontal processor. It also supplies, through RX529 and CR505, a +24-volt source voltage that is used in the vertical blanking circuit. CR509 provides the video B- source for the Black Level control.

The other secondary winding of the horizontal output transformer, with its built-in rectifier, supplies 13,000 volts to the second anode of the CRT. The return end of this winding is connected to the beam current limiter (Q807) which was described earlier.



HORIZONTAL DRIVER AND OUTPUT

POWER SUPPLY CIRCUIT

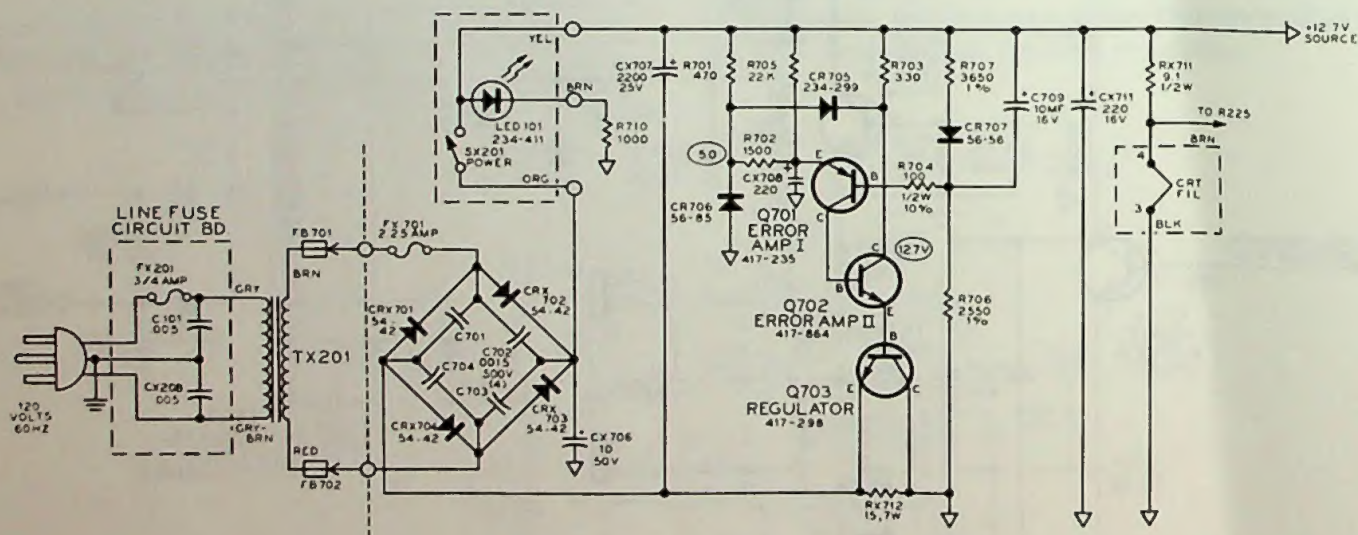
Power transformer TX201 and bridge rectifier diodes CRX701–CRX704 develop approximately 17.5 volts DC on capacitor CX707, with 1.7 volts of ripple. Ferrite beads between the transformer secondary and the rectifier circuit reduce line-conducted radio frequency emissions, while fuse FX701 provides secondary protection.

Regulator Q703 acts as a variable series element (paralleling RX712) that drops more or less voltage across it to maintain the output voltage at a constant 12.7 volts. When the output voltage increases or decreases because of line voltage fluctuations or load variations, the voltage change appears at the base of error amplifier Q701 through R707, CR707 and R704. The AC ripple is also connected to the base through C709. The Q701 base voltage is compared against the reference voltage at CR706, which is a 5-volt zener diode, and C708. Any voltage difference causes the collector current to increase or decrease proportionately. This collector current is amplified by Q702 and fed to regulator Q703. If the output voltage tries to rise, Q701 turns off Q702 and Q703, allowing a greater voltage drop across RX712.

Conversely, if the output voltage tries to rise, Q701 turns on harder and causes Q702 and Q703 to also turn on harder, reducing the voltage drop across RX712 to keep the output voltage at a constant 12.7 volts.

A unique feature of this circuit is its ability to switch from a regulator to an active filter at low line voltages. The voltage at the collector of Q702 is proportional to the available input voltage to the regulator. When the input voltage is too low to maintain 12.7 volts, the Q702 collector voltage drops below the zener reference voltage, causing CR705 to conduct. This additional current sinking through R701 disables the zener reference, causing the DC output voltage to drop and no longer be regulated for DC variations; so AC ripple regulation continues as the circuit acts as an active filter.

The 12.7-volt supply is reduced to 11.5 volts by RX711 for the CRT filament and also lights the LED (light emitting diode) as a "power on" indicator.



POWER SUPPLY

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance. you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least **THREE INCHES** of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022



HEATH COMPANY • BENTON HARBOR, MICHIGAN
THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

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